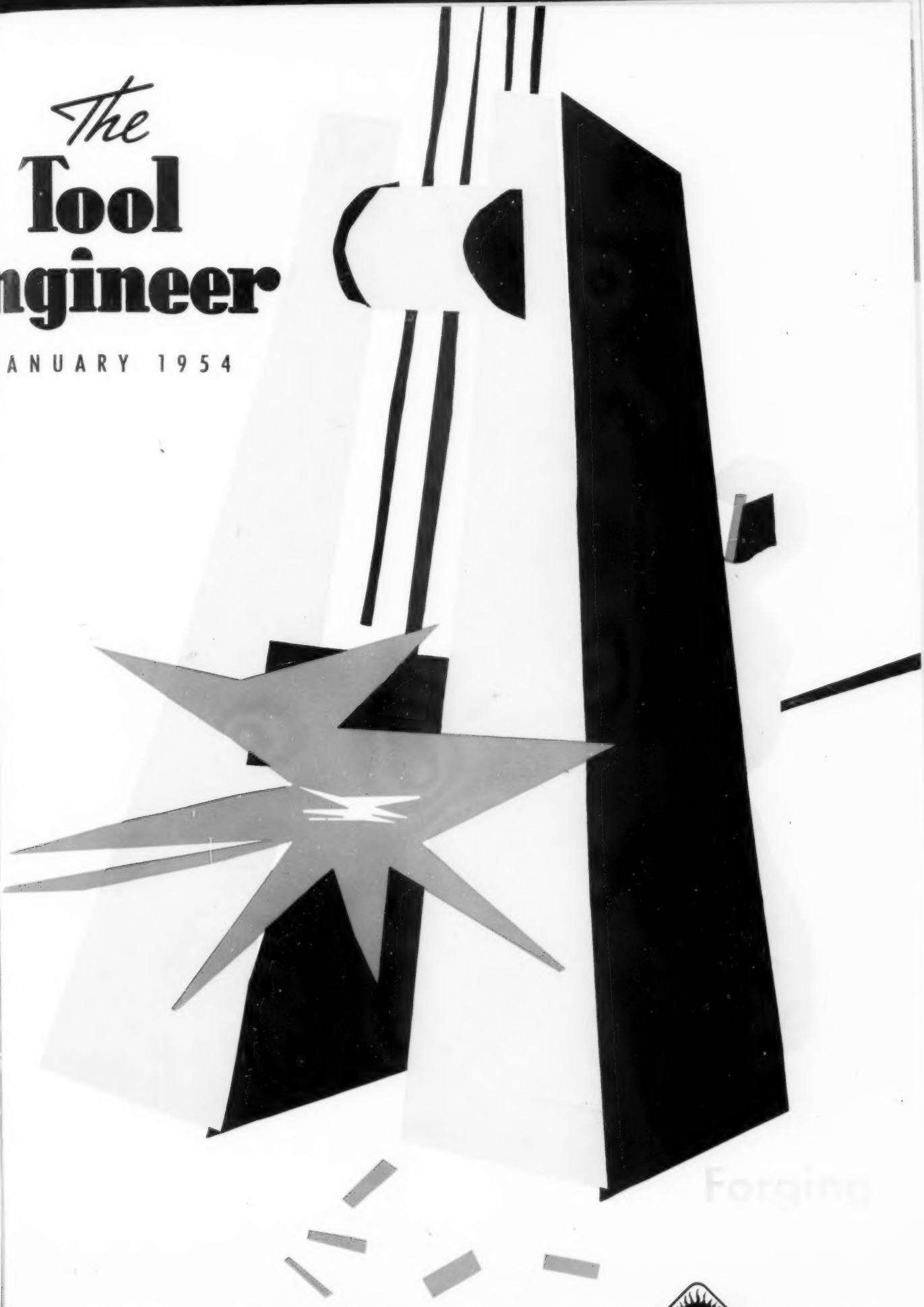
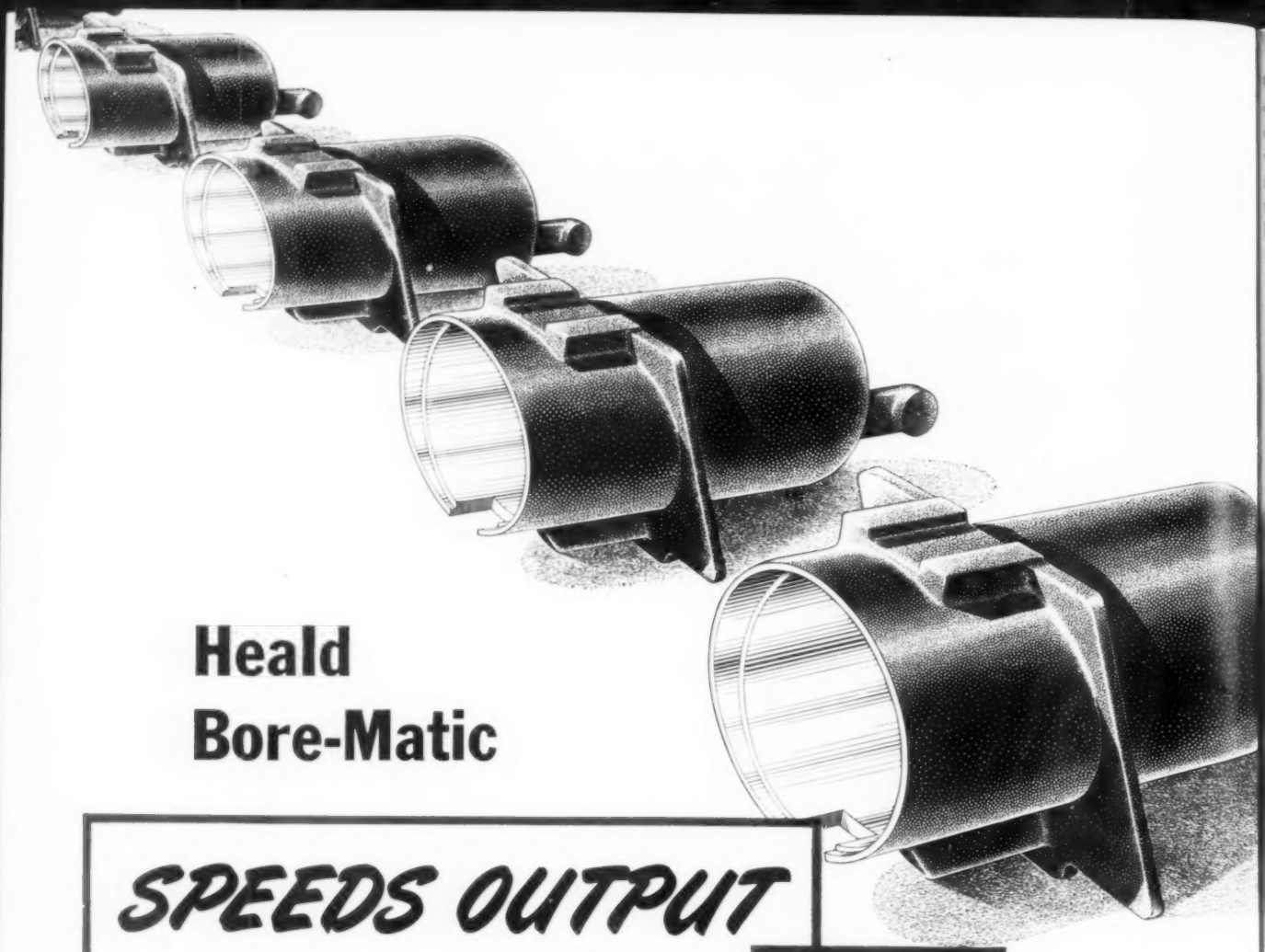
# *The* Tool ngineer

ANUARY 1954



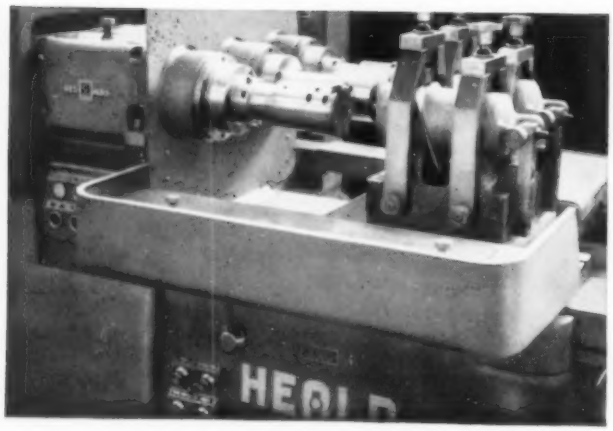
PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS



# Heald Bore-Matic

## SPEEDS OUTPUT

## of ironer cylinders 67%



• WHEN YOU COMBINE high cycle speeds, multiple boringheads and automatic indexing, you'll get faster, better production every time. The Heald Model 321 Bore-Matic shown at the left is a typical example.

By performing both roughing and finishing operations on two parts at a single loading, this machine speeded up the job by 67%. Three boringheads are used — the outer two for roughing the cast iron cylinders, and the center one for the finishing operation. A two station fixture on the cross slide indexes the work automatically. Parts are located in a Vee block fixture, with quick-acting clamps for easy loading and unloading.

*Remember* — when it comes to precision finishing, it pays to come to Heald.

Internal and Rotary Surface Grinding Machines and Bore-Matics

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**THE HEALD MACHINE COMPANY**

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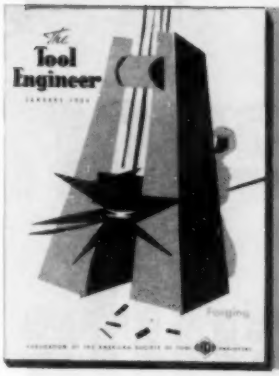
Cover: Starting our new [illegible] series with a bang, designer William Solms visited the Michigan Forging Co., where an inspiration was "hammered home." Solms recalls how his little sons used to make similar "fire pounders." This cover illustrates the theme of the forging article beginning on page 73.





# The Tool Engineer

Volume XXXII, No. 1 January, 1954


## TECHNICAL ARTICLES


Your Security—and 1954 (Editorial) . . . . . *By Roger F. Waindle* 35

Managerial Opportunities for the Tool Engineer . . . *By Edmund A. Cyrol* 37

Gadgets . . . . . 43

- Back Chamfer Tool . . . . . *By Andrew E. Rylander*
- Rotating Diamond File . . . . . *By P. Grodzinski*
- Gravity Fed Drill . . . . . *By Ian J. Peacock*

Tooling Problems When Specifying Ultrafine Pitch Gears . . . . . *By Louis D. Martin* 45

Copying Lathe . . . . . 52

Multiple Drilling in the Turret Lathe . . . . . *By Clifford T. Bower* 55

Tools at Work . . . . . 58

Spar Mill Profile Template Design . . . . . *By James M. Stolz* 60

Magnesium Forming—Part 3 . . . . . *By Francis L. Coenen* 65

Drop Forging (Tool Engineering Processes) . . . *By Ralph H. Eshelman* 73

A-C Motor Dimensions (Reference Sheets) . . . . . 83


## ASTE NEWS


Make Plans Now to Attend ASTE's Industrial Exposition . . . . . 86

Third ASTE Conference Held in Illinois . . . . . 88

Madison Sponsors Three-Day Institute On Tool Engineering . . . . 91


## DEPARTMENTS


Abstacts of Foreign Literature . . . . . 155
Field Notes . . . . . 151
Good Reading . . . . . 139
Letter from the Editor . . . . . 3
News in Metalworking . . . . . 108
Men at Work . . . . . 158
Technical Digests . . . . . 141
Technical Shorts . . . . . 135
Tools of Today . . . . . 112
Trade Literature . . . . . 147
Who's Meeting—and Where . . . . . 140
Advertisers' Index . . . . . 254



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# The Tool Engineer

## Every Plant Is a Gold Mine!

To mine gold from manufacturing plants requires tool engineers who use all available methods when they analyze operator motions. Most processes will yield surprising and gratifying results when operator effort is reduced to a minimum. Golden dividends will accrue from cost dollars saved or income dollars added. Substitution of push buttons for levers, relocation of controls, elimination of manual clamps from fixtures, or mechanization of loading and unloading produce similar results. Simplifying operations always results in lower costs.

Many years ago, a control engineer wagered that he could simplify the control of any machine tool. To prove his point, he eliminated several components from two machines chosen at random; redesigning the controls to perform as well or better than previously. Yet his method was relatively simple. If a control performed $n$ functions, its minimum requirements were $(n-1)$ components. He redesigned the controls with this basic concept.

In an extended program involving the redesign of a product for increased life and better performance at reduced cost, another engineer analyzed component parts with respect to their cost, performance and number. Each part was rated according to potential savings and those offering greatest reward were studied first. Savings from initial studies paid for more extensive research than had been originally contemplated.

Methodical approach to production operations will yield similar results. Machine tools, having the lowest ratios of actual machining time to cycle time and those with the highest production should be analyzed first to realize the greatest return. Micromotion analysis, effort required to set a handwheel, precision of setting required, frequency of motions involved, etc. will indicate whether relocation of controls is necessary, mechanization is justified or another approach to the problem is indicated.

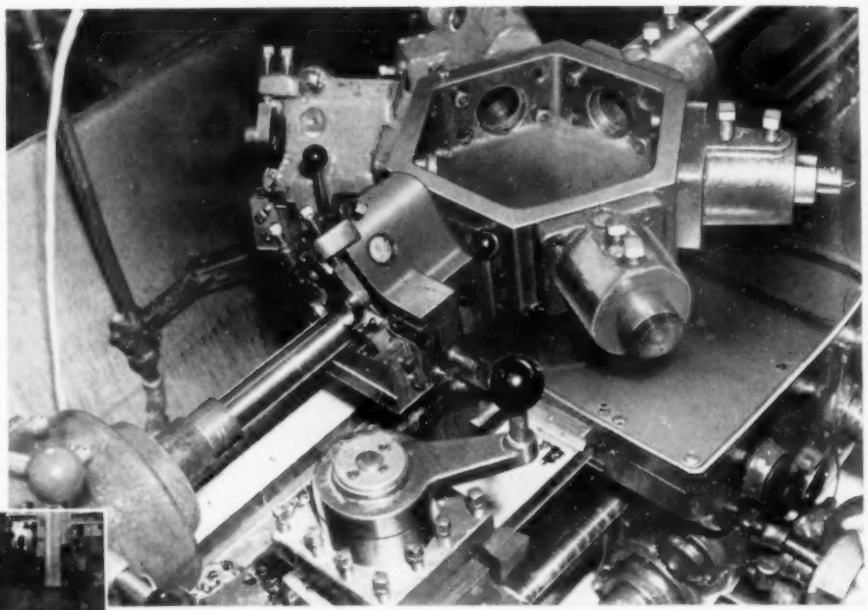
John W Greve

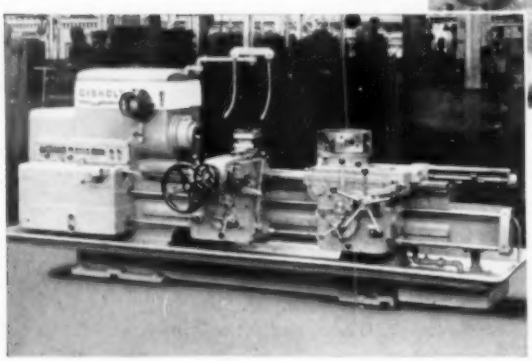
EDITOR

# take shaft jobs Like This:

## they take less time on GISHOLT TURRET LATHES

*Yes, even in lots as small as 5 or 10 parts, you can't beat turret lathes on this kind of work. Parts are machined complete in 2 operations—total time is less than 4 min.*





### *no extra equipment needed!*

With no more than your standard bar equipment, you're all set to cut machining costs on shafts like these. No previous operations . . . such as cutting to length or centering . . . are necessary. And with *two or more tools* from turret and side carriage, you have the basic advantage of turret lathe economy—the time saving that means lower costs.

Before you turn to extra equipment or special attachments, look into the possibilities of doing the job the quick and easy way on Gisholt Turret Lathes. Gisholt engineers will gladly help you.

**THE GISHOLT ROUND TABLE**
*represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.*

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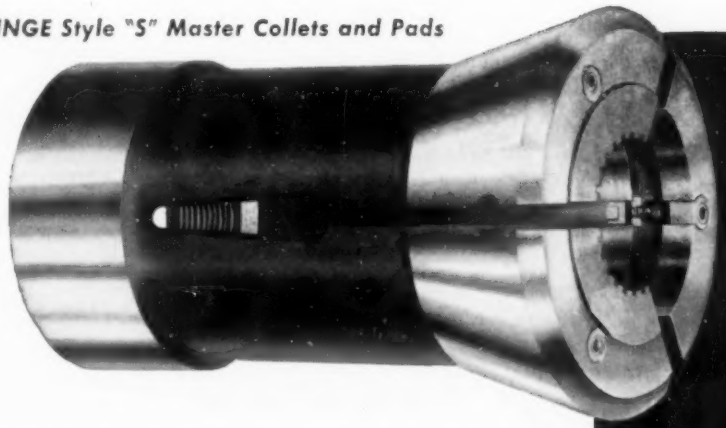
**TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES**

HARDINGE
ELMIRA, N.Y.

# MASTER COLLETS AND FEED FINGERS

## For Progressive Screw Machine Plants

*HARDINGE Style "S" Master Collets and Pads*



The Only MASTER COLLET With No Work Pressure on the Screw.

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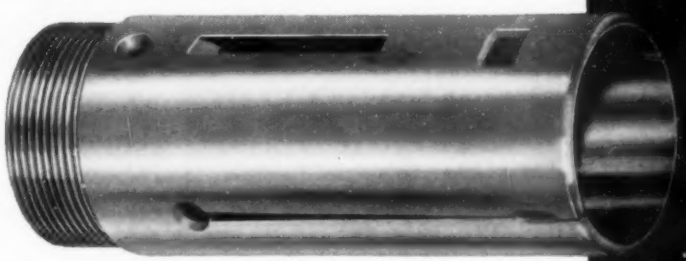
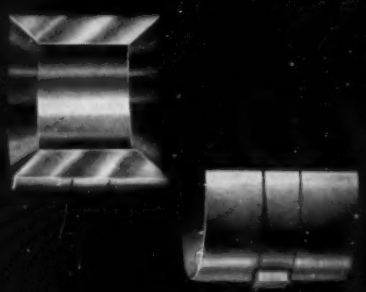


Pads Cannot Work Loose
No Screws No Pins

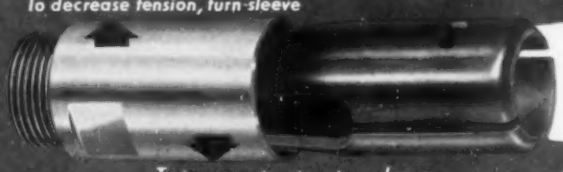


Pads interchange with Masters for different makes of machines having the same capacity.

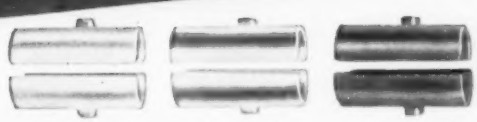
**Write for descriptive Bulletins.**

**HARDINGE Master Feed Fingers with Adjustable Tension - provide tension change to suit varying requirements.**

*To decrease tension, turn sleeve*



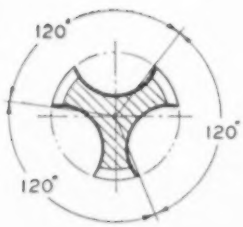
*To increase tension, turn sleeve*



Bronze Pads Steel Pads Cast Iron Pads

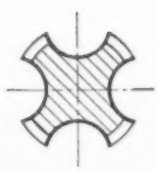
**HARDINGE BROTHERS, INC., ELMIRA, N. Y.**

1




Exact Flute Spacing

2

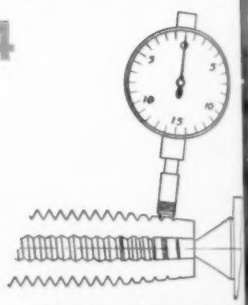


Uniform Flute Contours

3

Precision Chip Driver Contours

4



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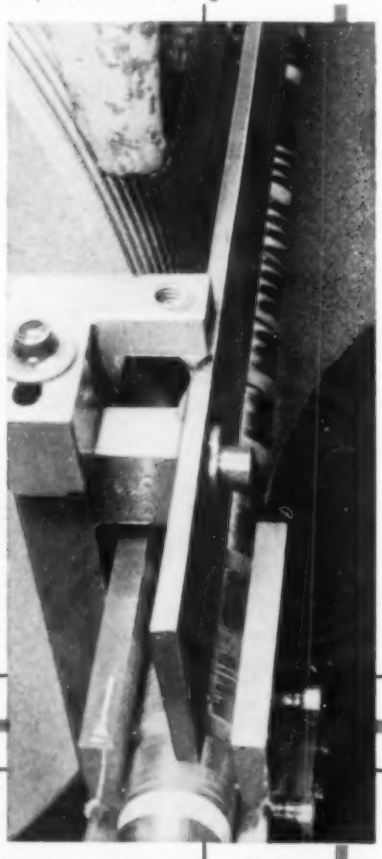
## ROTARY & STATIONARY DIE HEADS

A LANDMATIC Hardened and Ground Head is shown threading sucker rods to API tolerances at the Axelson Manufacturing Co. (Division of Pressed Steel Car Co.). 1 1/16" threads are cut on 4621 SAE steel rods at 25 surface feet per minute, with 1500 pieces produced between chaser grinds. This is one of 102 sizes and styles of LANDIS Threading Heads designed for commercial and precision threading.

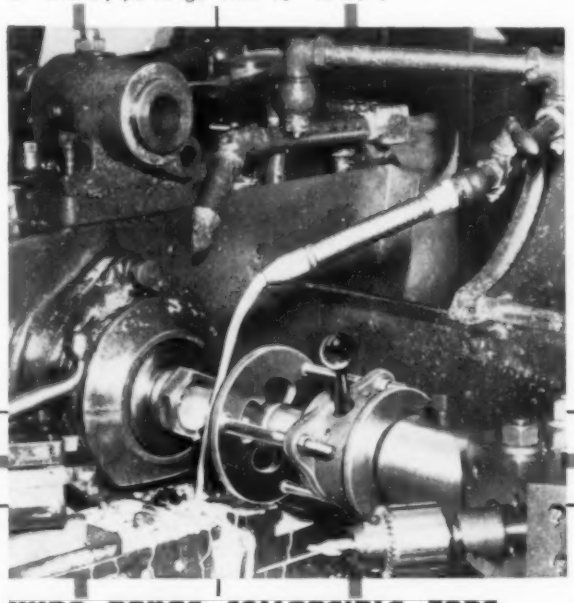
## PIPE & BOLT THREADING MACHINES

A #4 LANDMACO Threading Machine is shown cutting 1½" 12 pitch UN threads 2 29/32" long on **Unbrako** Screw Products to Class 3 fit at The Standard Pressed Steel Co. This is one of 90 sizes and styles of LANDIS Threading Machines having a bolt range from 3/16" to 6" and a pipe range from ⅛" to 20".



## CENTERLESS THREAD GRINDING

Five threading passes have been eliminated in the production of slack adjuster gear worms at Bendix-Westinghouse by using LANDIS Centerless Thread Grinders. 3½ pitch threads are ground on gear worm blanks of alloy steel heat-treated to 285-311 Brinell hardness in one roughing and one finishing pass. These LANDIS Thread Grinders will thread all diameters from 1/16" to 4¾".



## WIDE RANGE COLLAPSIBLE TAPS

The LANDIS ALT Tap, shown threading brass valve bonnets for 6500 pounds test pressure at the Combination Pump Valve Co., illustrates the LANDIS Tap **detachable head** feature. Four heads allow this Tap to thread nine diameters between 1⅜" and 3¼". This is one of 130 sizes and styles of LANDIS stationary and rotary Taps furnished for tapered or straight threading, with a range from 1¼" to 13⅜".

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# GRINDING
# TAPPING
# THREADS?

Here is a Complete Line of Thread Generating Equipment -- and 50 Years of Engineering, Research, and Production Experience to Help You Produce Those Threads FASTER—BETTER—CHEAPER.

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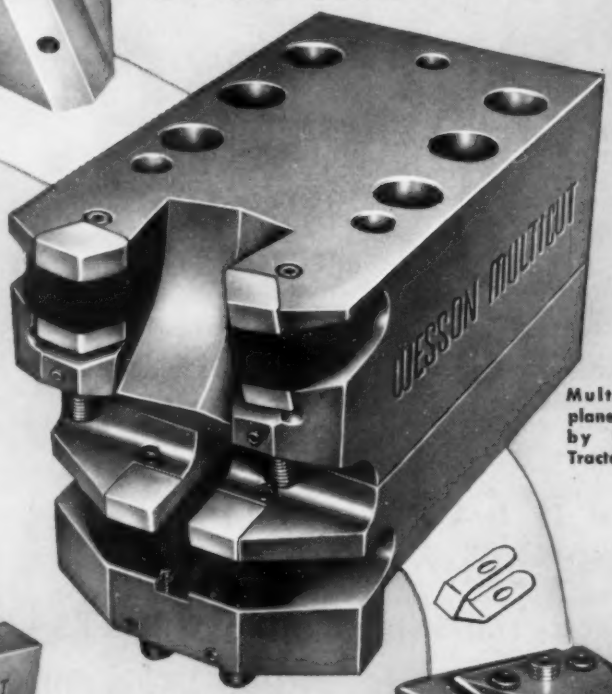
## Special and Standard

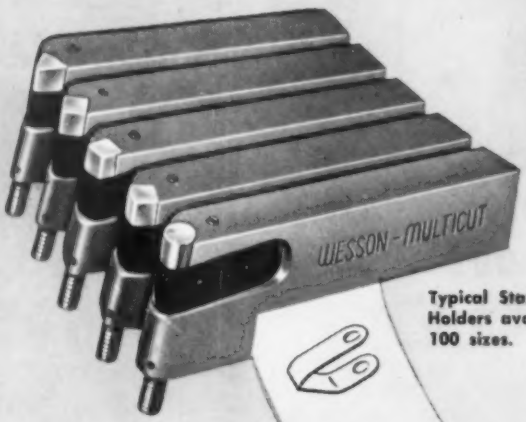
*with replaceable bands at low cost.*

Grooving tool used on the Cadillac Tank.

**ALL THE WEAR ON THE BAND MEANS EXTRA ECONOMY, EXTRA EFFICIENCY, HOWEVER SIMPLE OR COMPLICATED YOUR TOOL HOLDER PROBLEM!**




Multiple insert planer tool used by Caterpillar Tractor.




Typical Standard Wesson Tool Holders available in 10 styles, 100 sizes.

2 insert tool for turning Ford-Lincoln rear axle shaft on a Bullard Man-au-trol.

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*with Super Precision Roller Bearings and Separate Thrust Bearings*

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Spindles have the Pope System of lubrication and are dynamically balanced in full assembly.

Applicable to all new grinders and to those now in service. Write for price and delivery.

No. 95

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*Established 1920*

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# —until they SAW it!

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2. Cutting speed 300 feet per minute.
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4. 60 to 65 horse power registered by horse power meter during the maximum cuts.
5. Not a shimmy or whimper from the machine.

*They were amazed and convinced.*

This new model Pacemaker is endowed with the power, stamina and convenience that combine to produce a thoroughly dependable and highly productive unit.

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*designed for gear tooth accuracy, long cutting life, new feeds and speeds*

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**Barber-Colman Company** *hob pioneers in*

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multithread hobs
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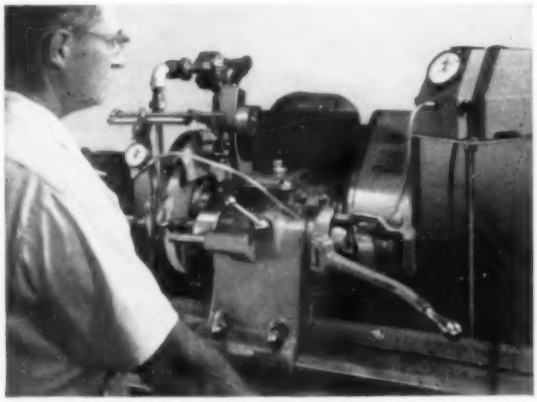

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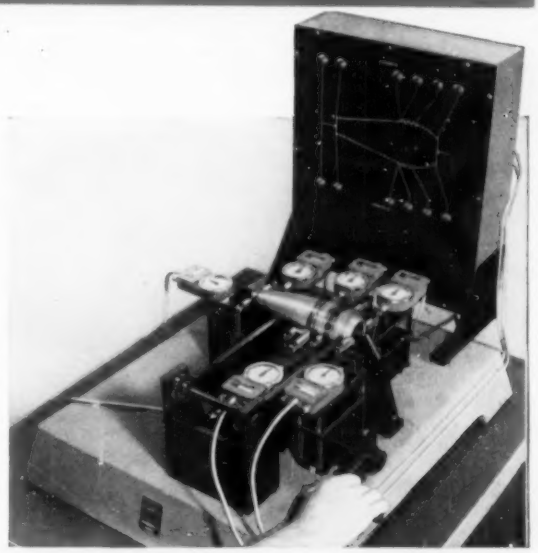
# has *Everything* in Gages for Dimensional Control

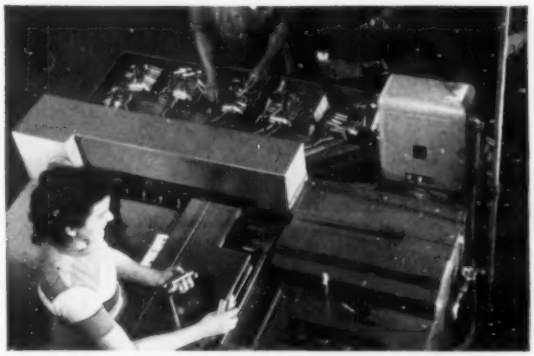
Multiple dimensions inspected simultaneously and quickly. (1) A single or individual light indicates at a glance if one or more dimensions are wrong. Or (2) separate lights identify incorrect dimensions and indicators show *how much*.

**PICTURE PANEL GAGES**



Invaluable for selective assembly methods of production. Parts are measured and sorted into any number of dimensional categories with great accuracy and speed. 100% inspection without interfering with production schedules. Semi-automatic or hand fed.

**AUTOMATIC SORTING GAGES**



Federal can process engineer, design, and build complete sets of gages for any production job: Can often save money for you by modifying *stock* gages. Consult Federal before you process your next job. Save time and money and get better gages.

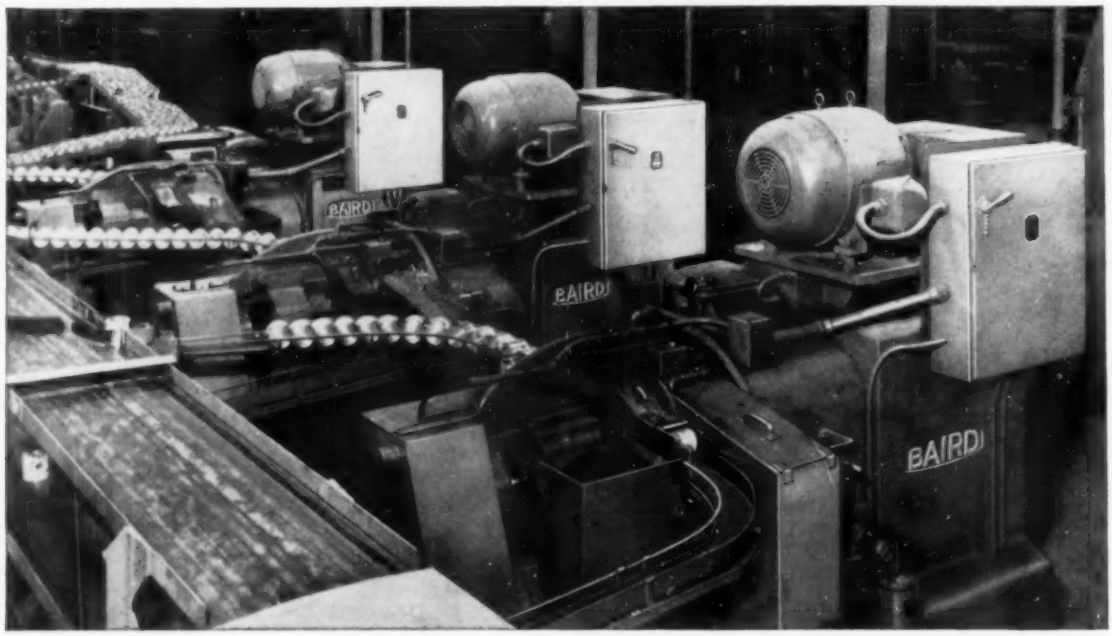
**ENGINEERING GAGE SERVICE**

**FEDERAL**

**Largest manufacturer devoted exclusively to designing and manufacturing *all types* of DIMENSIONAL INDICATING GAGES**

ASK **BAIRD** ABOUT IT!

# HIGH PRODUCTION TOOLING




## BAIRD *Automatic* CHUCKING MACHINES
## *Join mass production lines at new* FORD *plant*

The Baird Machine Company is pleased to share, with other manufacturers of modern automatics, in the high speed production at the Ford Motor Company's new Cleveland Engine Plant.

Shown above is a battery of Baird Chucking Machines. They completely finish-turn the engine piston, and finish the oil ring grooves to size. Machines are automatically loaded from the conveyor and automatically discharge the pistons when they are completed. Operations are fast, continuous, and to close-tolerance machining.

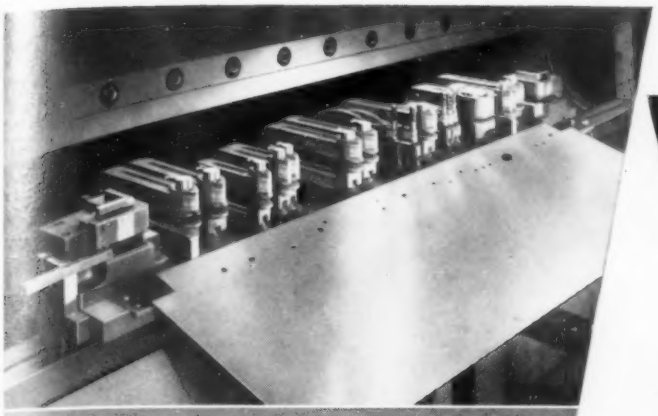
The Baird 76H Chucker (7"-chuck, 6-spindle, horizontal machine) combines, in a single automatic indexing cycle, such operations as turning, facing, drilling, tapping, threading, grooving, and chamfering . . . if desired. Automatic electrical and mechanical safety devices prevent damage when setting up, when loading is not within cycle time, or when any motions are out of sequence.

Other valuable features are: easy access to all tooling, individual tool slides, individual spindle speeds, automatic chucking, maintained accuracy over a long service life.

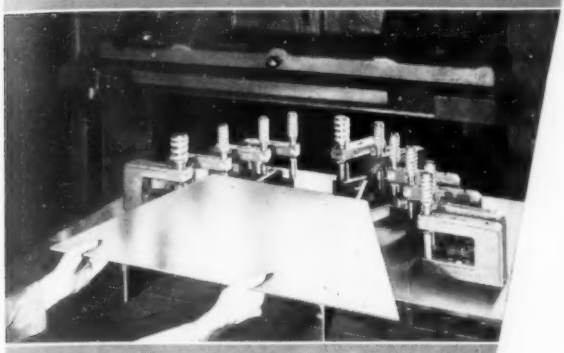
If you require repetitive production of this nature . . . either hand load and unload, or entirely automatic . . . ask Baird engineers for details.

*the* **BAIRD MACHINE COMPANY**
STRATFORD • CONNECTICUT

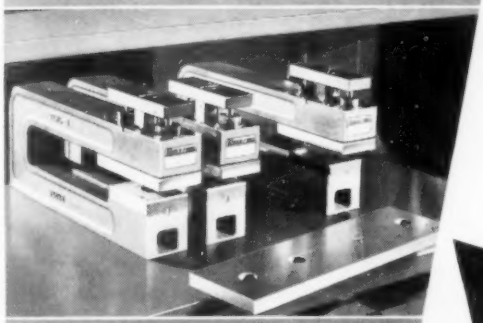
**AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS**



Showing Wales Type "BL" Hole Punching and Type "N" Notching Units in a combination press brake setup for punching and notching mild steel up to 1/8" THICK.

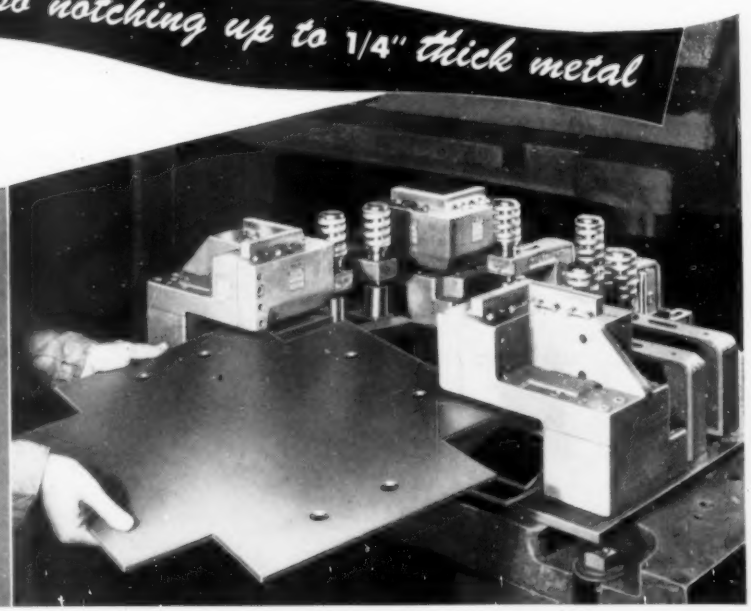


A stamping press setup of Wales Type "CJ" Hole Punching Units for punching mild steel up to 1/4" THICK.



Showing a setup of Wales Type "HS" Hole Punching Units in a press brake for punching mild steel up to 3/4" THICK.

Showing a setup of Wales Type "NJ" Notching Units in a stamping press for notching mild steel up to 1/4" THICK.



PUNCHING 1/8", 1/4" AND 3/4" THICK METAL?

## standardize on

# WALES

## Hole Punching Units

Only Wales Hole Punching and Notching Units provide the numerous *patented features* plus the *time and cost saving advantages* that have made it "standard practice" with thousands of metal fabricators to *standardize* on this *exclusive* equipment.

Wales independent, self-contained Units eliminate costly, single-purpose custom dies, reduce expensive setup time and practically eliminate press "downtime."

The same group of Wales Units may be interchangeably set up in stamping presses and press brakes. In many cases, setups of Wales Units are in production the same day a hole punching pattern is released by your engineering department.

The multiple advantages of Wales Hole Punching and Notching Equipment are too MANY to tell here, so write for fully-illustrated, functionally colored catalogs TODAY.

**WALES-STRIPPIT CORPORATION**

George F. Wales, *Chairman*

393 **Payne Avenue, North Tonawanda, N. Y.**

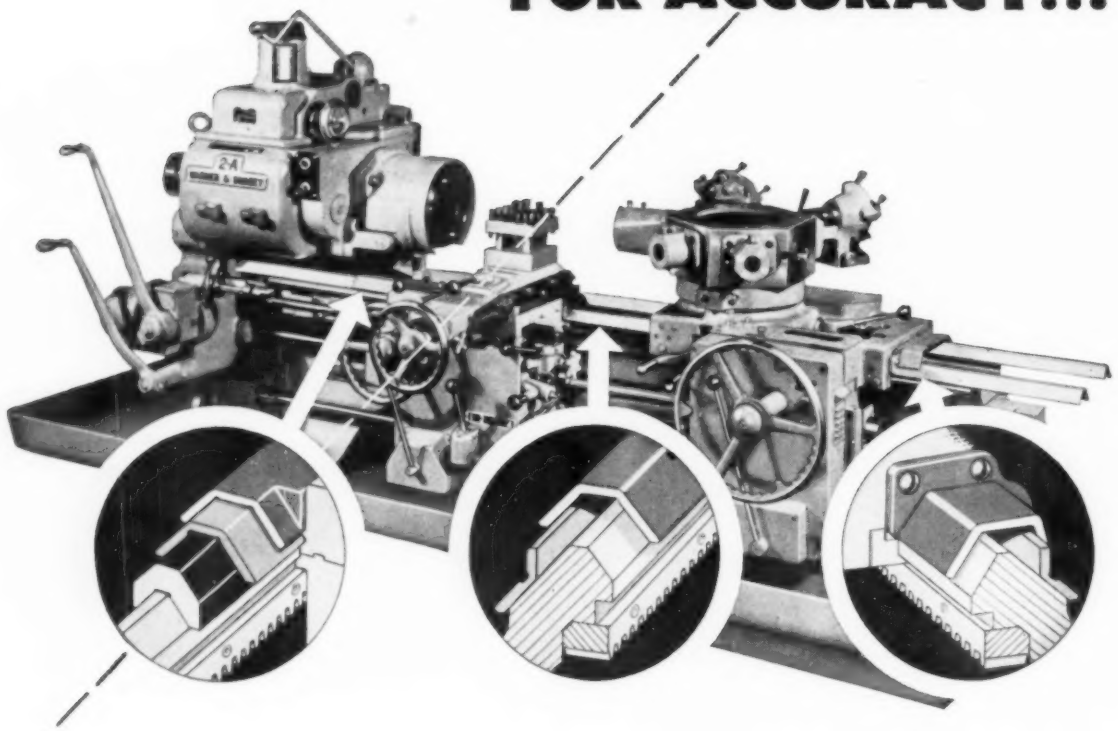
*(Between Buffalo and Niagara Falls)*

Wales-Strippit of Canada, Ltd., Hamilton, Ontario

***Specialists in Punching and Notching Equipment***

*also notching up to 1/4" thick metal*

# FOR ACCURACY...



## • There is no substitute for VEE-WAYS

NEW MACHINE ACCURACY is maintained for many extra years of service because of a basic design which is a distinctive feature of all Warner & Swasey Saddle Type Turret Lathes. VEE-WAYS of high test nickel iron are cast integral with the DIAGONAL RIBBED, one piece bed. Induction hardened by an exclusive process for greatest wear resistance, the VEE-WAYS are then ground to smoothness and precision. The most heavily loaded saddle slides over the ways with an ease which makes hand wheel control almost effortless for the operator.

The VEE-shape distributes weight and pressure of saddle and loaded turret to make carriage self-aligning.

The heaviest roughing cuts and the finest finishing cuts are taken without necessity of adjustment . . . without possibility of weaving.

Patented Telescoping Way Covers (see illustration above) completely protect the VEE bed from scratches from chips or damage from dropped tools, etc.

Equally important, the Way Covers prevent the floods of coolant from washing away the film of lubricant carried to the Ways by automatic lubrication.

VEE-WAYS are only one of many valuable features of Warner & Swasey construction, but they are a fundamental principle which makes Warner & Swasey so easy to operate, and so outstandingly efficient in preserving extreme precision under long years of hardest service.

Your Warner & Swasey Field Representative can explain *all* the features of Warner & Swasey Machine Tools which make them so advantageous for low-cost production.

WARNER & SWASEY
*Cleveland*
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER & SWASEY MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY



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They're Precision Machine Ground-From-The-Solid

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BORING BITS & OTHERS

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***Send for complete catalog NOW!***

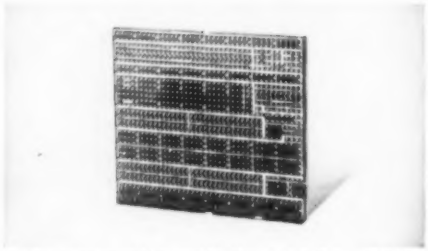
THE ATRAX COMPANY
NEWINGTON 11, CONNECTICUT

# Make Sure You're Not Missing These Tooling Advantages!

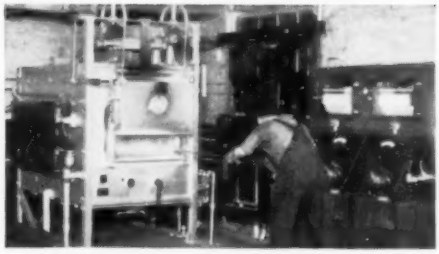
**Make this *3-Minute Check* . . . Discover how a *modern* die steel can give you diemaking and production advantages no other steel offers you!**

Are you aware of how tool and die steels have been improved in the last 5 to 10 years? New steels are now available that handle easier, run longer between grinds, bring down diemaking costs. Here are facts about *Vega* (Air-Tough) Die Steel—just one steel in Carpenter's Matched Set of 12 modern die steels. Compare *Vega* and what it offers, with the die steel you're using. Check it point by point. You'll see what a difference a Carpenter Matched Tool and Die Steel can mean to *your* production and profits. THE CARPENTER STEEL CO., 154 W. Bern St., Reading, Pa.

**Here is what *Vega* gives you . . . *COMPARE* it with the die steel *you* use . . .**

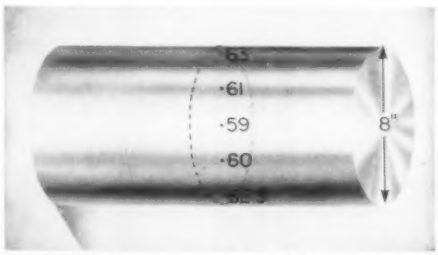


**Freedom from Size Change in Hardening.** The mold for this $9\frac{1}{2}$" x $10\frac{1}{2}$" plastic control panel has 1,280 $\frac{5}{32}$" dia. holes, six $\frac{3}{8}$" dia. horizontal ports for heating and cooling, plus eight $\frac{3}{4}$" dia. tapered holes on the edge. *Vega* was the *only* steel of many tried that could successfully hold the close tolerances of .0002" on centers of the 1,280 holes! Will the steel you use behave in hardening like this?

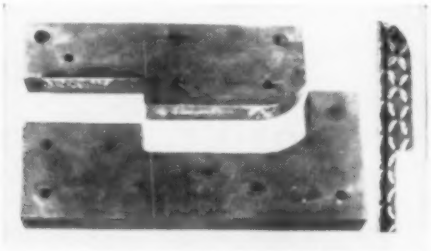


**Easy, Low Temperature Heat Treating.** You heat treat *Vega* from a temperature of only 1550°F (actually 200°F *lower* than the 5% chromium air-hardening grades!). No need for special, high temperature furnaces! Are you getting the benefits of *low temperature* heat treating from the air-hardening steel you use?

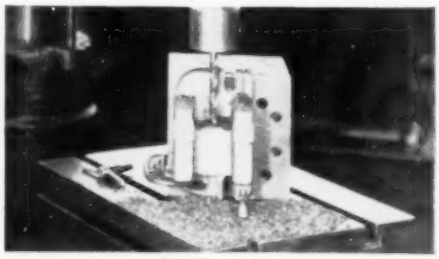
**Extra Economy in Hardening.** Because of *Vega's* lower hardening temperature, troublesome pack hardening to avoid excessive scaling is usually unnecessary. Does the air-hardening steel you use give you this *extra economy* in hardening?




**Uniform Deep Hardenability.** *Vega* gives you the advantages of uniform, deep hardenability in very heavy sections. For example, *Vega* hardens to Rockwell C-60 from surface to center in sections as large as 8" round. How does the steel you use compare on this score?



**Toughness with Good Hardness.** This punch and die blanks $\frac{1}{4}$" diamond threshold plates at one stroke. With previous air-hardening die steel, tools chipped and broke before any real production was made. With *Vega* these tools are in regular production—and there are no signs of wear or chipping to date. Will the steel you use perform in service like this?



**Good Machinability.** Unlike ordinary air-hardening grades, *Vega* has a well balanced analysis with a small percentage of hard-to-machine alloys. Field tests prove it to be one of the easiest of all air-hardening grades to machine. If the air-hardening grade you use fails to provide this *good machinability*, you're missing out on lower costs.

## *change to* Carpenter STEEL

**Matched Tool and Die Steels**

***. . modern* die steels engineered to meet *today's* requirements!**

Export Department: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"

Get Immediate Delivery . . . Call your Carpenter Mill-Branch Warehouse, Office or Distributor

## what type and size

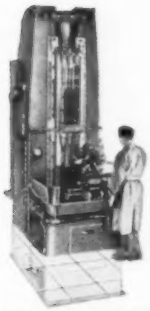
# LAPOINTE

## BROACHING MACHINE do you need?

*Whatever it is, you can be sure that it is available among the* **more than 50** *types and sizes of broaching machines that are* **standard with LAPOINTE!**

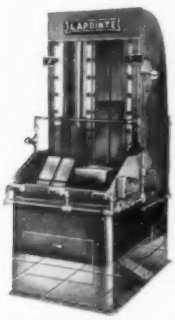
Here are a few machines representing basic designs. They embody engineering skill and broaching experience extending back over fifty years — a wealth of experience exceeding that of every other broaching machine manufacturer.

**LAPOINTE** can take the responsibility for the *complete broaching problem,* because we also design and build *fixtures* and *broaches* for use on our broaching machines.



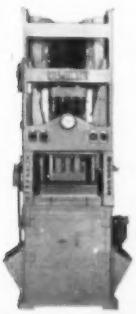
**SRV**

3 to 25 ton, 30" to 90" stroke



**DRV**

3 to 25 ton, 30" to 90" stroke



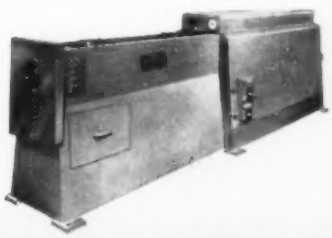
**VPU**

10 to 25 ton, 36" to 60" stroke

**VPD**

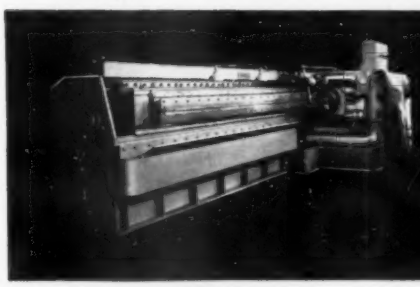
5 to 50 ton, 36" to 60" stroke

Write for Catalog No. 5



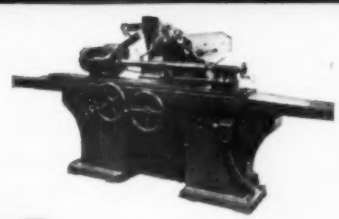
**HP**

2½ to 50 ton, 30" to 78" stroke



. . . and here's the *latest* LAPOINTE machine:

**SRHE** Capable of broaching speeds up to 300 fpm and *more!* Strokes 90" up to 180".



**SHARPENERS** in these sizes:
36" 60" 72" 80"

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*In England: Watford, Hertfordshire*

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*a New addition to our popular line of* SELECTIVE FEEDING DEVICES

NOW! A FEEDING UNIT FOR ALMOST ANY SPECIFIC APPLICATION!

*Also* EXTENDED ENGINEERING SERVICE—

ENABLING US TO DO THE COMPLETE TOOLING FOR YOUR INDIVIDUAL FEEDING OPERATIONS

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A proved method based on the VIBRATORY PRINCIPLE. Provides fully automatic, oriented, single line feeding to Grinding, Packaging, Inspecting and many other automatic machines and operations. Will scientifically feed light, fragile parts that normally could not withstand tumbling.

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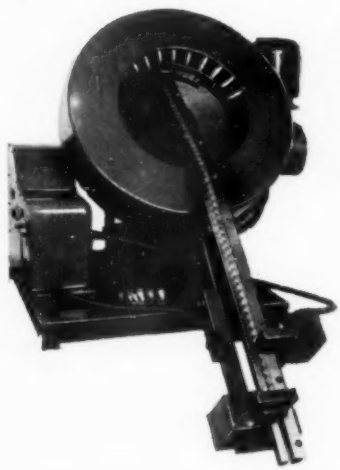

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**OUTSTANDING FEATURES:**

A precision machine for drilling, boring, recessing, and milling work. Table can be rotated to 360 degrees. Accurate automatic locking of rotary table every 15 degrees, and at any other position by hand. Table and spindlehead have variable hydraulic feed. All coordinate dimensions can be set by dials, and adjustment made through optical microscopes. Mechanical spindle feed can be changed without stopping machine. Automatic stop of spindle feed. Optical measuring system operates in conjunction with vernier scales. Vertical movement of column motor operated.

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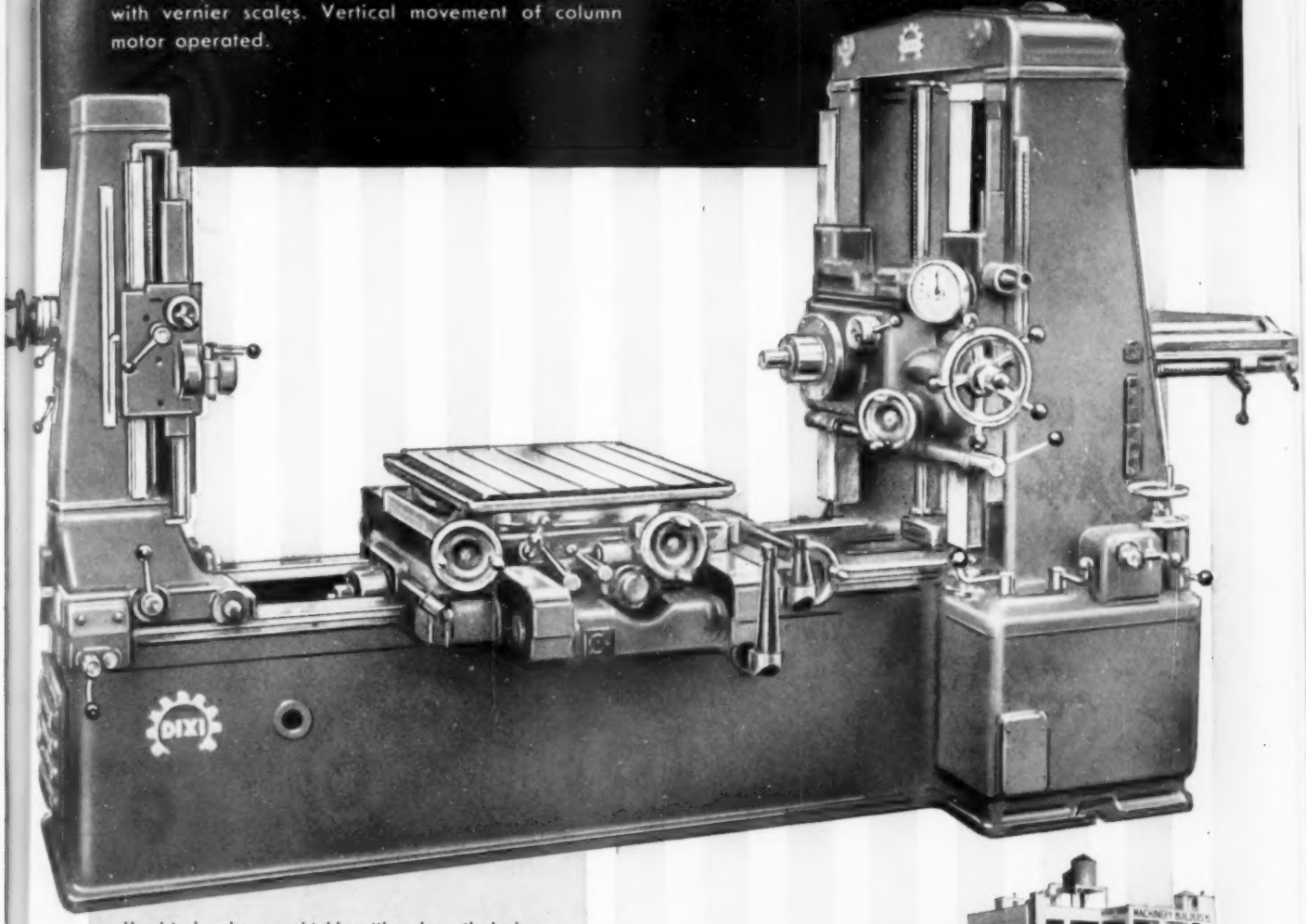


Headstock, column, and table settings by optical microscopes to insure overall accuracy of .0002". Built in rotary table with optical microscope. Tables size 28¾" x 32⅝". Max. distance table to spindle 19.7". Table travel, 23⅝". Hydraulic feeds for all functions 0-78" per min. #40 Taper spindle. Spindle travel 24.4". Spindle speeds 32-1350 R.P.M. Feeds .0015"-.010" per rev.

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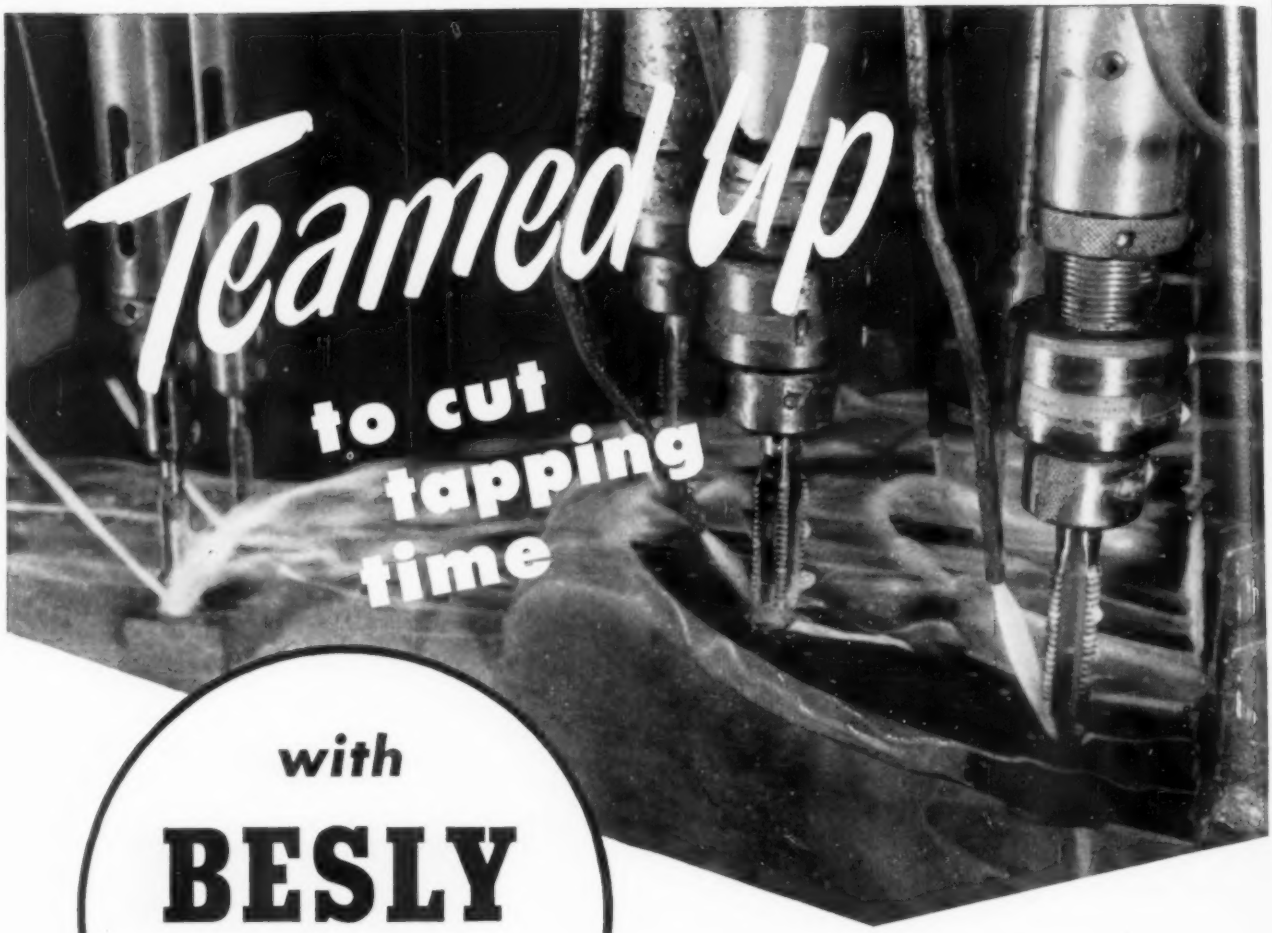


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AT CATERPILLAR TRACTOR CO. ... Besly Taps are used for precision, multiple-tapping operations. For example, on the D8 Tractor cylinder block, a Besly set-up taps 15 holes simultaneously in the fly wheel end.

BESLY TAPS, teamed up with the experience of a BESLY Field Engineer, can give *you* better threads, too ... with high production and long tap life. Let our engineers prove with a no-cost trial on your toughest job that BESLY gives you more tapped holes ... better tapped holes per tap dollar. Ask your distributor for proof now.

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BESLY

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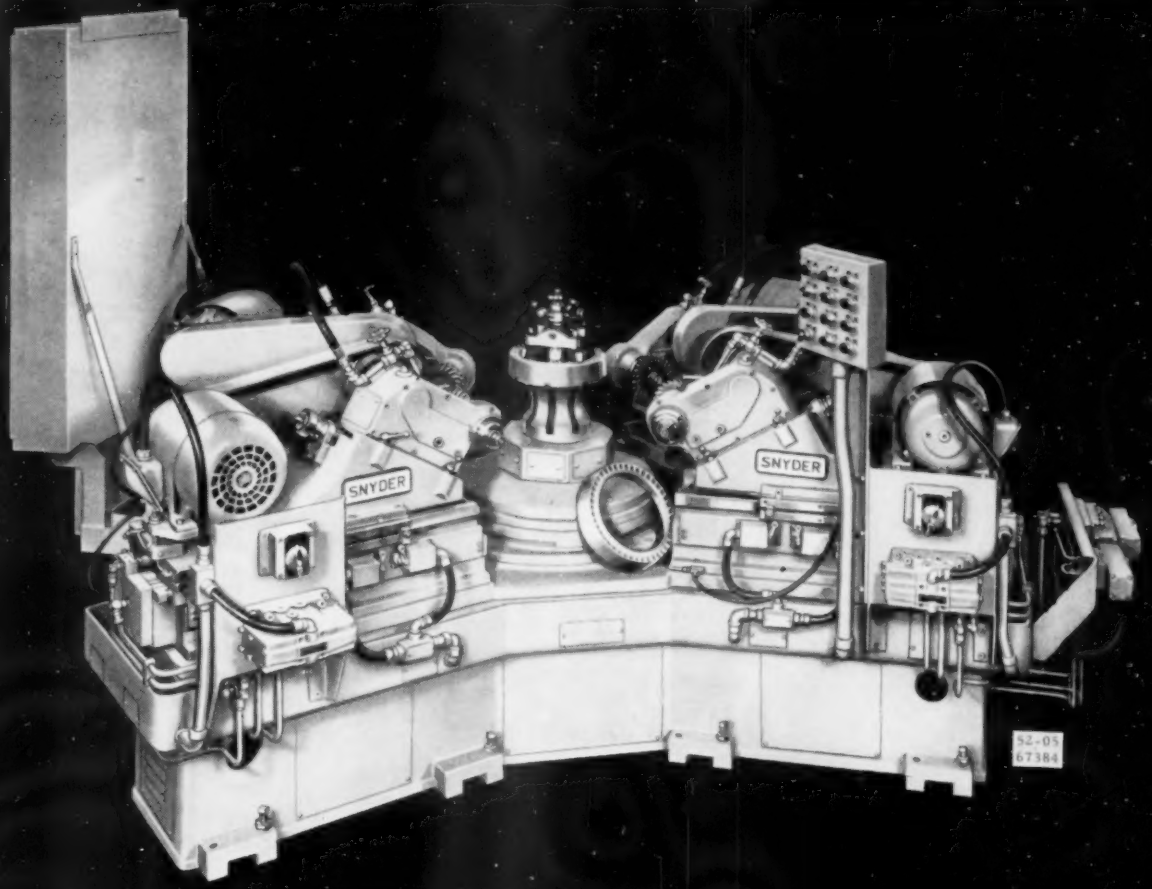
BESLY Drills, Reamers and End Mills . . . High Speed Cutting Tools in all types and sizes.

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AT **80%** EFFICIENCY

# SNYDER

**TOOL & ENGINEERING COMPANY**
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# When you want on any cutting-tool

## here are 5 reasons to call your

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**2 AMPLE STOCKS:** Your Morse-franchised Distributor is ready to supply you with the Morse Quality Cutting Tools you need. *New Morse methods of production, inventory control and expediting put him in a far stronger position in '53 than ever before.*

**3 ON-THE-JOB EXPERIENCE:** Your Morse-franchised Distributor knows his way around on cutting-tool applications, to give you *increased* production and *reduced* costs.

**4 CLOSE CO-OPERATION FROM MORSE ENGINEERS:** On any "cranky" or special problem, your Morse-franchised Distributor can immediately summon the help of Morse's top technical men.

**5 PROVEN RESPONSIBILITY:** Your Morse-franchised Distributor is a respected member of your business community. You can have full confidence, *as Morse has,* in him and his men.

THAT'S WHY IT'S ALWAYS GOOD BUSINESS TO "CALL YOUR MORSE-FRANCHISED DISTRIBUTOR"

**MORSE TWIST DRILL & MACHINE COMPANY, NEW BEDFORD, MASS.**

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## Cutting Tools

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***Call your***
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for prompt, dependable, quality service to match the quality and dependability of Starrett products.

When it comes to precision measuring tools — the tools that set your company's standard of accuracy — you have complete confidence in Starrett. It is the name you specify, the name you look for before all others on tools you trust. Starrett makes more than 3000 fine tools for every precision measuring need . . . 3000 opportunities to buy with confidence through a convenient and reliable source of supply — your Industrial Distributor.

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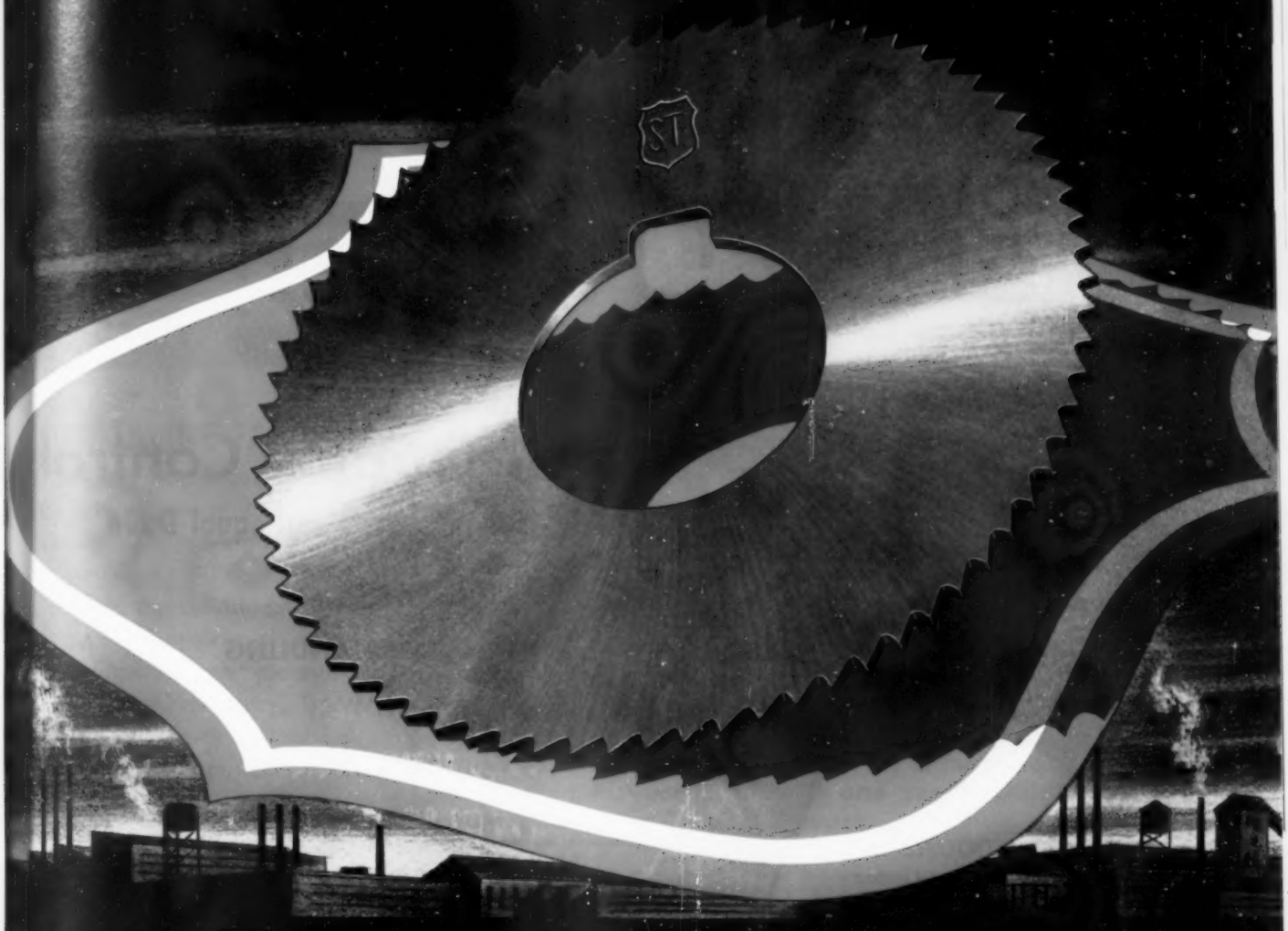
**MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS • DIAL INDICATORS • STEEL TAPES PRECISION GROUND FLAT STOCK • HACKSAWS, BAND SAWS and BAND KNIVES**
**THE L. S. STARRETT COMPANY, ATHOL, MASSACHUSETTS, U. S. A.**

"STANDARD for tough jobs since 1881"



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Call your Industrial Supply Distributor for Shield Brand Slotting Cutters.
Specialized factory service available everywhere.

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**NO plug gage can equal DuBo**

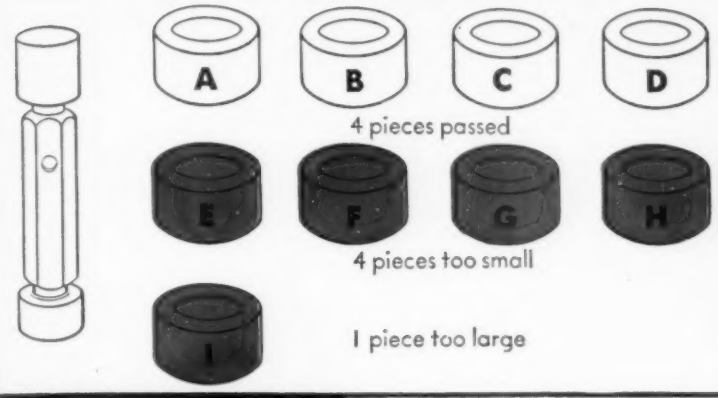
- . . . IN ACCURACY
- . . . IN EASE OF HANDLING
- . . . IN SENSITIVITY
- . . . IN LIGHT WEIGHT
- . . . IN LONG TERM SERVICE
- . . . IN COST SAVING AND PROFIT

Like so many items of modern design, DuBo Plug Gage *looks* different and *feels* different from the conventional plug gage. And even craftsmen of the old school, used to time-worn methods, quickly get the feel and take pride in the use of this *different* tool. *Added to that are the many actual cases where DuBo, after a fair trial, has replaced conventional plug gages.*

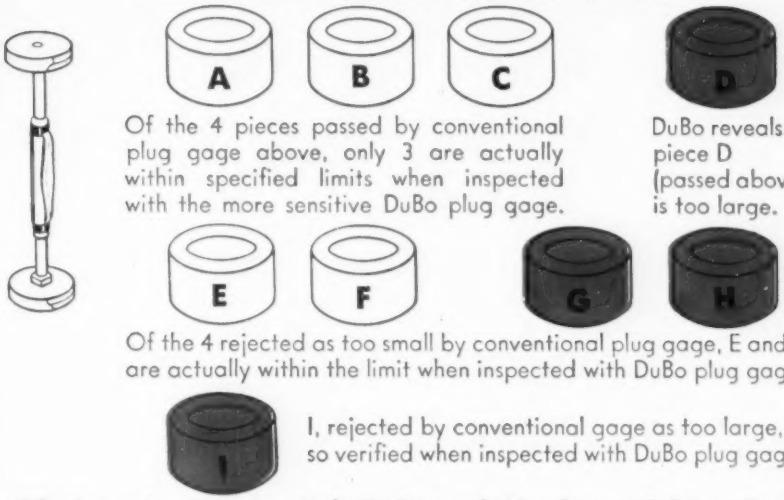
With exceptional ease of handling, DuBo gives a precise, definite and sensitive check of bore diameters, directly and with no element of confusion, even in unskilled hands. In the same application, DuBo reveals dimensional variations such as taper and out-of-round which ordinary plug gages cannot indicate.

# An ABC Demonstration of DuBo* Plug Gage Superiority

Inspection of 9 pieces using conventional plug gage
Bore Diam. 1.500"; Total Tolerance .001"




RESULTS of same inspection using DuBo Plug Gage




Of the 4 pieces passed by conventional plug gage above, only 3 are actually within specified limits when inspected with the more sensitive DuBo plug gage.

DuBo reveals piece D (passed above) is too large.

Of the 4 rejected as too small by conventional plug gage, E and F are actually within the limit when inspected with DuBo plug gage.

I, rejected by conventional gage as too large, is so verified when inspected with DuBo plug gage.

**Of nine pieces inspected, DuBo reclaimed two false rejects and rejected one piece that had been passed by ordinary plug gage inspection. Apply even a fraction of this ratio to a day's production in your own plant and you'll realize the advantage of using DuBo Plug Gages.**

## COST-SAVING FACTORS

DuBo Plug Gages outlast ordinary plugs many times. Extremely light in weight (in the larger sizes, 70% to 80% lighter than cylindrical plug gages of equivalent diameter) and requiring no jockeying into position for entry, DuBo effects economies in that important cost item, actual inspection time.

## Use DuBo for Precision Plug Economy

When inspecting parts under quality control sampling procedure, it is important that those parts which may be close to either end of the tolerance range be properly classified. The definiteness and simplicity of DuBo gaging is a decided advantage in this type of inspection. Anyone who has tried to enter a cylindrical plug into a hole only .0001" larger than the gage, knows how difficult it is. For even skillful workers there is a point at which it becomes doubtful whether the bore is actually smaller than the gage size, or if it is larger and merely close. With DuBo Plug Gage, even an unskilled worker can easily enter the gage under any condition and quickly interpret bore conditions correctly. There need be no border-line cases of doubt regarding the proper classification of a bore. Use of the DuBo Plug Gage minimizes the cost of parts needlessly rejected and the expense accruing from those incorrectly passed.

**TRY DuBo!** Sense its craftsmanlike feel and balance. See how easily it enters, even in undersize bores . . . how gentle manipulation of the handle accurately reveals internal conditions. Use it on a *fussy* job and you'll KNOW why DuBo is replacing old time plug gages everywhere! Refer to Catalog C, Pages 18, 19, 20, 21. Or, write or phone for more detailed information.

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*Photo courtesy Scovill Manufacturing Company, Waterbury, Connecticut.*

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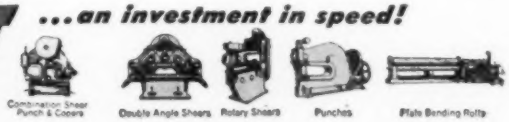

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# The Tool Engineer


## Your Security—and 1954

What does New Year mean to you? What is this Happy New Year we've heard so often lately? A new year, just like a new day, is a wonderful opportunity to do the things for which we didn't have the time last year or yesterday.

Here's what you can do for yourself! Engineers—in fact all professional men—must continue to learn if they wish to maintain their positions in their chosen fields. Why? Because we live in a constantly changing world and to do our best work we must know the latest and best methods. Just pick out a single item (a material, a type of machine, a method important in your plant) and make that your target in 1954. Decide to learn all there is to know about just that one project. Then, when you look back on 1954 one year from now you will have a great deal more satisfaction over your accomplishments than looking back on 1953 will afford you.

At a recent meeting of the ASTE Research Fund Committee in New York, able Committeeman Louis Polk made the remark "Luck is where opportunity and preparedness meet." We all like to be lucky—the question is whether in 1954 we will prepare ourselves to better meet our opportunities a year from now.

ASTE is one form of continuous self-education for you—attend more technical meetings, read more of this magazine, pick up your Tool Engineers Handbook more often and read a section. Self-sufficiency and an inner security are the rewards of the educated man. They can be yours if you get started in 1954.

Happy learning—Happy New Year!

R. F. Waindle

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—*Photo courtesy Whirlpool Corp.*

**Fig. 1. To determine the quantity of a product that can be absorbed by the market, to produce it economically and to deliver units on schedule requires industrial coordination at the highest level. To people who can coordinate the activities of other people go the richest rewards.**

# MANAGERIAL OPPORTUNITIES for the Tool Engineer

**By Edmund A. Cyrol***

**E. A. Cyrol & Company**
**Chicago 3, Ill.**

YEARS AGO, when business establishments were small and usually owned by a single individual, positions of managerial responsibility were limited to the owner or to members of his family. Today few businesses are owned by one man. As manufacturing techniques and products, *Fig.* 1, became more complex and the tools and machines required became more expensive, the individual had to join with men of specialized training to form the managerial team and to join with others who had available capital to form the financial foundation for the business.

This transition has occured since the beginning of the twentieth century. The owner-manager gave way to the manager who acquired his position through training and ability, and to multiple ownership through the sale of stock. The change will never be complete. There will probably always be owner-managers in business but most of the business volume, measured in dollars, in this country will be conducted on a multiple ownership, professional manager basis.

The tool engineer is in excellent position to gain by the continuing change if he will appreciate it and his relationship to it. Unmistakable evidence is available that proves greater rewards go to the manager than the technician, *Fig.* 2. The man dealing primarily with people is generally better paid than the man dealing with things. This seems to be true in every field: Baseball professionals are better paid than university mathematicians, crooners receive greater pay and recognition than laboratory technicians working on cancer research and writers of fiction receive more wealth and publicity than writers on the effects of pearlitic inclusions on the machinability of castings. Whatever the justice or injustice may be, the facts lead to the conclusion that technical experts are not the best paid members of our society.

The tool engineer who has recently entered industry and is interested in mapping his progress should recognize this. He must become aware of the human relations side of industry. Unfortunately, universities have only recently recognized tool engineering as a specialized field of engineering and do not have time in the usual four-year course to give sufficient stress to managerial possibilities. The young tool

*Senior member ASTE Chicago chapter

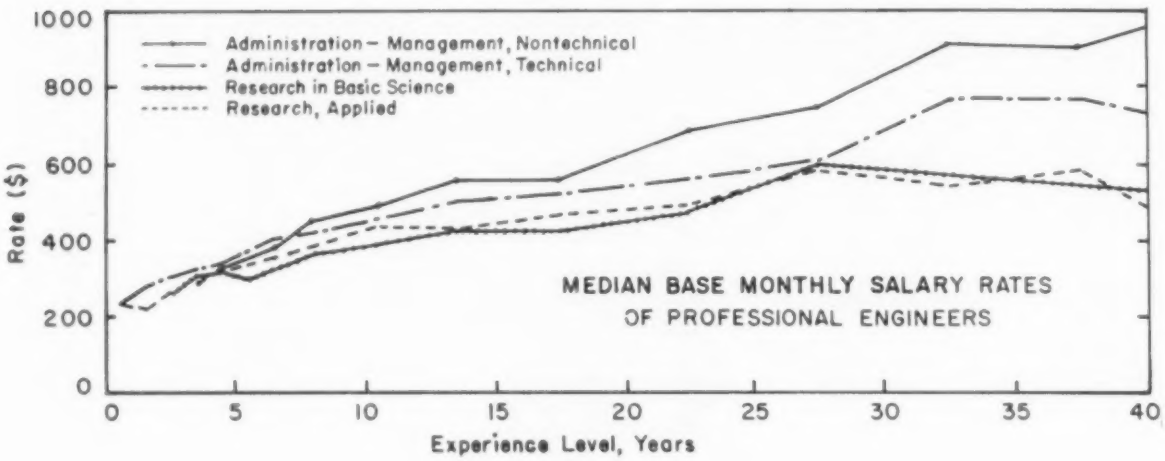
engineer who would be a manager must train himself to appreciate the human side of industry and the socio-economic status of the executive.

The tool engineer who masters the skills required to deal effectively with human beings receives no guarantee of success as an executive, but if he fails to obtain these skills he will never become an executive. Routes that lead to higher positions and greater pay can be traced by studying careers of those who have made the transition.

Recent graduates in tool engineering have the advantage of an organized course at college level. They possess elementary knowledge of tool and machine design, manufacturing processes, report and letter writing, and the usual engineering fundamentals. The older tool engineer may have engineering training in some other branch of engineering, such as civil, mechanical or electrical. In the tool design department, either one has the basic knowledge required to do the job of tool design. It is here that the tool engineer makes his first cooperative contacts with people, contacts that are limited to a rather narrow phase of the industrial effort. At this point he must become aware that no person can have an individual or independent position in a business organization. His knowledge of cooperative human effort on the creative level should exert itself in the routine of his department. The first step, then, is to understand and appreciate cooperative effort on the level of the tool designer.

The National Society of Professional Engineers, in a recent survey, found that although engineers spend more than 30 percent of their time in technical work, 70 percent of the surveyed companies use engineers in non-technical jobs; mainly in some managerial capacity.

Cooperation, organization and human relations are necessary adjuncts to even the simplest projects that require the efforts of more than one person. Even the most brilliant engineer is ineffectual if he cannot communicate his ideas to and work harmoniously with other members of a group. A tool engineer must determine the processes by which the desired product is to be manufactured; prepare process sheets for factory use; select or adapt machines, tools, and gages for economical production; and estimate tooling costs. He can do this alone on a small project. On a large project it will be necessary for him to discuss methods and processes, and present his point of view in such manner that his suggestions will be accepted and so that he will be given due credit for his contributions.




There is general agreement that a shortage of executive manpower exists. This is an ideal condition for the tool engineer who is ambitious to become a member of management. He can attain a better position, with its rewards, by becoming aware of the interplay of human relations and by doing his technical job in a first-rate manner. Once he has decided upon his course, he must be patient and await promotions on the basis of merit. If promotions are slow in coming because his company fails to keep lines of promotion open, he must look elsewhere for better opportunities. It is an unfor-

tunate fact that many companies do not keep their potentially most valuable men because they fail to build men to higher responsibilities.

The tool engineer who finds himself part of a company that is meeting the executive shortage through management courses within its own organization, *Fig.* 3, should be ready to take full advantage of such opportunity. Quite often companies find it hard to get enthusiastic acceptance of such courses because they are considered "kid stuff"—beneath those who are selected to be trained. Other companies have a regular system of rotating young men who have shown talent. The ambitious sensible man selected for such rotation will study the operation of all departments, will be cooperative and rather hesitant about suggesting improvements or reorganization.

**Fig. 2. Based on a report by the Engineering Joint Council Committee in 1946, this chart indicates that engineers who deal with people receive more remuneration than those who deal with things.**

If he has learned his job without benefit of formal training, the tool engineer who feels his progress is too slow can take advantage of management courses being given in ever greater numbers of colleges, *Fig.* 4, during evening hours. If such courses are unavailable and if the company that employs him lacks such opportunities as mentioned, he can read some of the numerous books on management and industrial organization.

Would-be executives must realize that all functions of an organization are equally important and that there are many ways to obtain effective low-cost production. The tool engineer who would become a manager must consider his specialty in relation to other management functions that lead to efficient production. The better he understands these other devices, the better he can find the proper balance among them. When he shows this understanding, his recognition as managerial timber will usually come, though it may be slower than he would like.

Loyalty to the company is of major importance. It is only when the tool engineer—or any specialist—widens the horizon of his interest in the company's policies and makes an attempt to understand the importance and integration of all its functions that he can increase his opportunities to produce results and be recognized.

To be an executive it would seem to be necessary to know what an executive is. Dictionary definitions refer to "executive talent", "executive branch of a government" and persons "doing executive work" but they go no further. One description of an executive's work has been given by H. A. Moses in the following quotation, which, in spite of its humor has a strong foundation of fact.

> "Executives are a fortunate lot, for as everybody knows, an executive has nothing to do. That is except: to decide what is to be done; to tell somebody to do it; to listen to reasons why it should not be done; why it should be done by somebody else; or why it should be done in a different way; to prepare arguments of rebuttal that shall be convincing and conclusive; to follow up to see if the thing has been done. To discover that it has not been done; to inquire why it has not been done, and to listen to excuses from the person who should have done it and did not do it; to think up arguments to overcome these excuses.
>
> "To follow up a second time to see if the thing has been done; to discover that it has been done, but done incorrectly; to point out how it should have been done; to conclude that as long as it has been done it might as well be left as it is. To wonder if it is not about time to get rid of a person who can't do a thing correctly; to reflect that the person at fault has a wife and seven children and that certainly no other executive in the world would put up with him for a moment, and that probably any successor would be as bad or worse.
>
> "To consider how much simpler and better it would have been if he had done the thing himself in the first place; to reflect sadly that if he had done it himself he would have been able to do it right in about twenty minutes, but as things stand, he himself spent two days trying to find out why it took somebody else three weeks to do it wrong; but to realize that such an idea would have been highly demoralizing to the organization because it would strike at the very foundation of belief that an *executive really has nothing to do.*"

A brief outline of the various management functions will serve to bring into focus the activities that are associated with successful management. All companies, regardless of size, include all functions, but in small organizations each executive will have responsibility for several phases of the business.

Management of a manufacturing plant has as a goal the delivery of desired quantities of a product at the lowest price and at the time desired by the customer. To this end, management must plan manpower, material, and tooling and equipment needs.

—Photo courtesy Whirlpool Corp.

**Fig. 3. (above) Large industrial organizations conduct courses to round out management trainees while they work at jobs with narrow responsibilities.**

**Fig. 4 (right) Management seminars sponsored by technical and management societies and universities, assist industrial management in training future replacements. Broad experience is gained from seminars because companies with different viewpoints are represented.**

The function identified as production control brings these things together under management's direction. A review of production control shows the interrelation of the different functions.

Top management directs the sales department (or the economist, or commercial research director) to issue and maintain a current sales forecast, if the product be manufactured to stock. If the product is manufactured to customer orders, top management must establish a clear-cut policy to govern filling orders so that planned production will not be disorganized every time an important—for the moment—customer sends in an order and so the shop will not be forced to run according to a "hot list." The sales forecast must be detailed enough to allow actual determination of requirements so orders can be placed with vendors for raw stock and finished parts. It must be kept current with revisions made as orders come into the sales department.

After top management has informed production control how much of a product the market will absorb and when it will absorb it, the design of the product must be considered. The engineering department prepares a complete bill of materials and a set of blueprints. To be of maximum use, the bill of materials must specify the product model and name; the part names and descriptions; their arrangement into assemblies and subassemblies; the material specifications; whether the part is to be manufactured or purchased; the number of parts required in the finished product; and the amount of material used in each part. As with any source of information, the bill of materials must be kept up to date through proper use of engineering change requests and notices.

Frequently management has found, upon attempting to achieve greater control over factory operations, that rather than the engineering department, the man on the bench had the information on parts used in a particular model. Part prints must give complete data on dimensional tolerances, finish, heat treatment and assembly fits, and they must be controlled in the shop and kept current.

Knowing how much, when and what is to be produced, production control also must be told how it is to be produced. Management, therefore, makes

shop routings available. As with other data necessary to effective control of factory processes, shop routings originate outside the production control group; usually in the tool engineering department. *Fig.* 5. To be useful in the shop and to the production control group, the routing must give the operation sequence; operation description; work center by symbol or description; manpower requirements; perishable tools, jigs and fixtures needed; job classification to be assigned; and the rate of production.

Good control of shop operations requires only one other basic bank of information: good inventory records. These may be maintained in the purchasing department, a separate material control group or in the production control department itself. Wherever they are housed, they must be kept up to date in a manner that correctly reflects the state of inventory. For purposes of production control, these records must give balances under at least the following headings: material on hand, material assigned to specific shop orders and material on order with expected delivery dates. A correct record of this type is impossible without strict physical control of material.

With this information in hand, production control can operate its planning section. Production can now be planned. Materials, machine capacities and manpower can be brought into balance because the sales forecast specifies quantities of the finished product required and the time when it is wanted; bills of materials indicate the raw material and finished parts needed. The question of total material needed is answered.

The routing indicates the manpower and machines required. Thus the plant capacity is determined in light of production needed to meet the sales forecast. If the sales forecast is too ambitious for the plant available, top management must decide whether to trim the sales forecast, increase plant capacity or augment plant facilities through subcontracting. Management must know, at a time when it can do something to correct the situation, that a sales forecast and delivery promises based on it cannot be met.

When the amount of product to be delivered within a given period is determined, inventory records are used to estabilsh the quantity of material to be purchased. Total material required minus material available equals the quantity of material to be purchased. At this point production is planned but not scheduled.

In many types of manufacturing plants planned production with some inplant expediting but without detailed schedules will allow efficient use of equipment and meeting of delivery dates. When scheduling is necessary, production control must establish dispatch points in the plant at which specific operational orders are issued to indicate which machines should be used at what times to meet the master machine load schedule. The quantity of parts to be run is determined from sales requirements or customer orders and the time required for the run is determined from the production standard given in the routing. This information indicates when the run must be started.

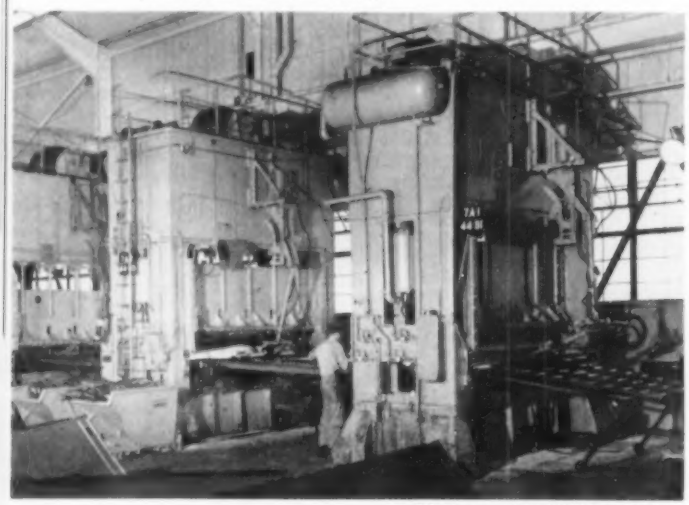
The machine to be assigned to the work is given by the routing. The time per piece for each machine operation is established on the basis of time study

*—Photo courtesy Industrial Management Society*

observation or on past production. The dispatch personnel also double as timekeepers. Subsequent comparisons of the total time allowed and the total time used determine worker efficiency. This is of interest to production control for planning future machine loads for similar operations, and to management for labor cost control purposes.

To achieve success with scheduling, a whole new group of requirements must be satisfied. Assembly schedules, for example, cannot be successfully maintained if unacceptable parts are delivered. Top management must establish quality control so that schedules can be maintained or, in case unacceptable material is produced within the plant, new lots can be scheduled and assembly dates reshuffled. Parts coming into the plant from vendors must be received on time and of acceptable quality. In addition to inspection of parts and materials on receipt, a clear channel must exist between production control and the purchasing department. With such a channel, late deliveries can be anticipated as soon as possible and runs using the parts that will be late can be rescheduled.

**Fig. 5. The tool engineer who aspires to managerial status must learn about all the other facets of production, design, planning, routing, purchasing and inspection while concentrating on doing a first-rate job of tool engineering.**



*—Photo courtesy Whirlpool Corp.*

Even when the proper material is delivered to the specified machine or bench and a worker of the required skill is available, all the conditions for scheduled production may not be fulfilled. Tools are needed. Normally, after a product is designed and processed, the required standard and special tools are brought into the plant. These tools are then controlled from strategically located tool cribs. Inventories of expendable tools must be replenished in relation to their use and all tools must be reground and reset as they wear. Tools can also be scheduled to the work center as they are needed. Inspection must ensure that tools are in condition to be used when they arrive at work centers.

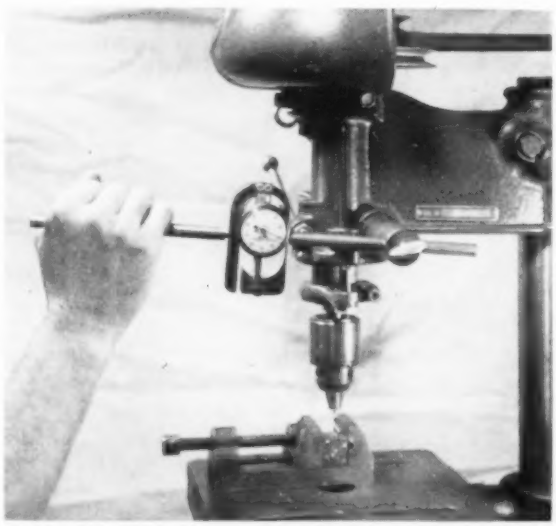
Having the tools, materials, purchased parts equipment, tooling and skilled manpower in proper proportions in a plant to produce the desired product is an interesting game. It is the game of the executive.

# Gaged Drilling Promotes Economy

FOR THE PURPOSE of cutting cost and improving efficiency, a novel application of a pressure gage has proved itself a practical production advantage.

Breakage of drills and taps in drill press work was the problem. Solution came about by substituting a split handle which contained a Dillon pressure gage as an important part, for the regular drill handle. Pressure is measured in pounds and maximum safe pressure for the operation in question can easily be determined by the shop or department foreman. Thus it is simple to avoid too great a pressure by merely staying under the maximum prescribed poundage. Accuracy of the gage is 0.01 of indicated reading, plus or minus, with an overload capacity up to 0.25.

The job of substituting the split handle is so simple that it can be quickly removed and replaced with the regular one for an operation not requiring the gage.



## Back Chamfer Tool

While there are many ways of making back chamfering or back spot-facing tools, the one illustrated has the advantage that it is easy to make and comparatively inexpensive. It is also fast in action and the cutter may be advanced or retracted while the spindle is rotating, if so desired. Furthermore, it can be used with equal facility on a drill press or turret lathe, as it will work equally well horizontally or vertically.

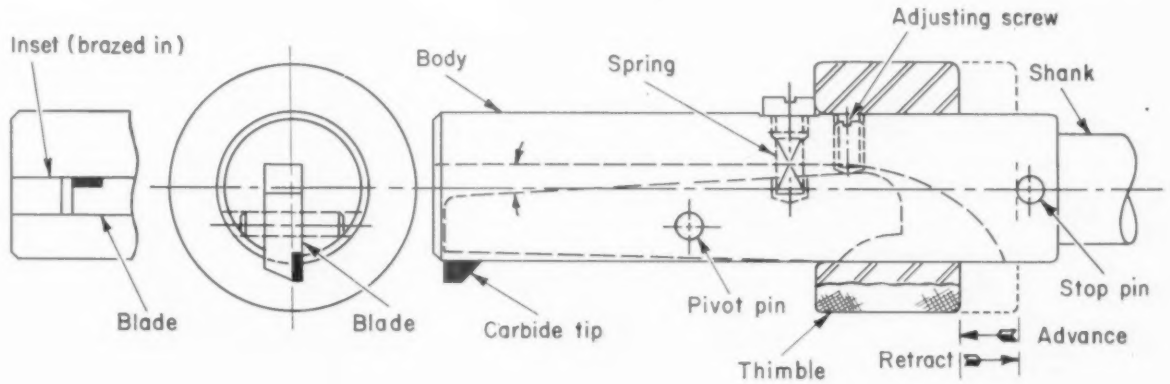
The drawing shows the general principles. The tool must be proportioned to the work on which it is to be used. Essentially, it consists of a slotted body, a carbide-tipped blade and a thimble. The blade, which rocks on a pivot pin, has a brazed-on carbide tip at its forward end. The other end is shaped to simulate a quick-rising cam. The cutter is advanced by sliding the thimble ahead, and stays out during the cut. On completion of the cut, the tool is retracted by sliding the thimble back to starting position.

The blade is retracted by a stiff spring backed by a headed screw, which also acts as a stop for the thimble. A stop pin on the shank end of the body prevents the thimble from slipping off. The adjusting screw should be set just tight enough so that when the thimble rides up on the cam, there is sufficient friction to hold it during the cut, yet permitting comparatively free action.

The angle of the cutter should be ground with the cutter advanced; also, the cutter should swing somewhat beyond the stipulated diameter of chamfer.

As will be seen from the sketch, the slot is off center so that the top of the blade is slightly above the center line. This is to provide backing for the blade. Should it be necessary to further strengthen the body, an inset may be brazed in at the end, as shown at extreme left. This should only be necessary where the body diameter is so small that insufficient stock is left for backing. The shank may be straight for turret lathes, or tapered for use with a drill press.

*Andrew E. Rylander*
*Golden Gate Chapter*



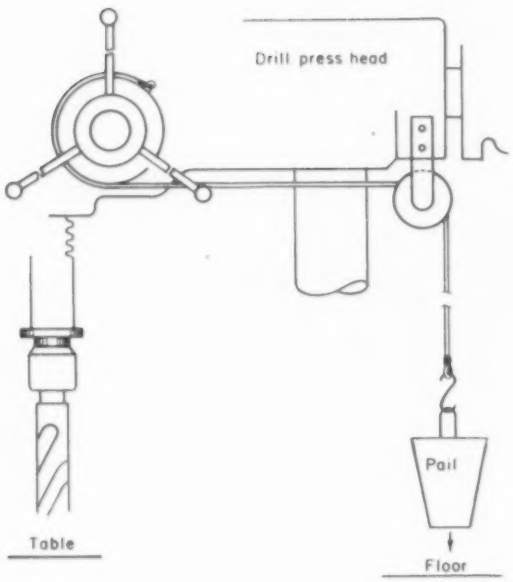

***Contributions for these pages describing short cuts for the tool engineer are welcome. Finished drawings are not necessary. Payment for accepted articles is made upon publication.***

## Gravity Fed Drill

When necessary to bore and machine a large number of forged billets, lathe time was saved by rigging an old pillar drill close to the roughing lathe. The drill had no power feed, but a gravity feed was improvised in the following manner.

On the rack-engaging pinion spindle of the drill,

a drum made from an old pulley was placed inside of and close to the star handwheel. This drum was secured by a setscrew and at one side on its periphery a small hooked pin was fixed. At the rear of the drill close to the motor a short bracket was fastened to carry a guide pulley. The setup was completed with a length of brake cable and a medium sized pail and hook.




One end of the cable was looped and fixed to the small hooked pin. The cable was given two or three turns round the drum and then led back over the guide pulley. The pail was hooked to the second looped end, as shown in the accompanying sketch.

In use, the spindle of the drill is retracted and clamped by the quill lock. A billet, previously faced, is clamped in a rough fixture on the machine table. By releasing the quill finger lock, the drill engages the work. The pail is loaded with sufficient unfinished billets to cause the drill to feed into the work at a suitable rate.

The depth stop is adjusted so the drill just passes through the workpiece, and the drum is adjusted by the setscrew so the pail touches the floor just before the drill breaks through. The lathe operator only has a few seconds' work clearing the drill through and retracting it for the next workpiece, while the lathe faces a workpiece with power cross feed. A dull drill soon shows up by requiring more weights in the pail. The drill press is functionally unchanged and can be returned to previous condition in a moment by unhitching cable and pail.

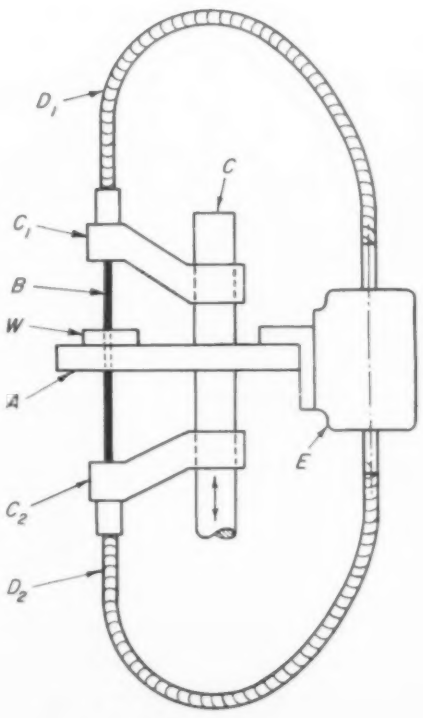
*Ian J. Peacock*
*Cumberland, Britain*

## Rotating Diamond File

An attachment has been developed utilizing the recently announced rotated diamond sawing wire of E. Winter & Sohn, Hamburg, for sawing hard metals. The device consists of flexible shafts fitted to both upper and lower tool holds of a reciprocating filing machine as shown in the illustration. As shown, the arrangement consists of table *A*, sawing wire *B*, reciprocating holder *C* with brackets $C_1$ and $C_2$, flexible shafts $D_1$ *and* $D_2$, electric motor *E* with shaft ends driving flexible shafts, and workpiece *W*.

With this setup a $\frac{1}{8}$-inch hardened and heat-treated steel plate can be sawed at the rate of $\frac{1}{32}$ inch per minute. Stamping dies can now be produced from a single piece so the difficult fitting of dies composed of several parts is avoided. The shape desired is marked on the die. A small hole is made with a diamond file and the diamond sawing wire introduced.

*P. Grodzinski*
*Member at Large*
*London, England*



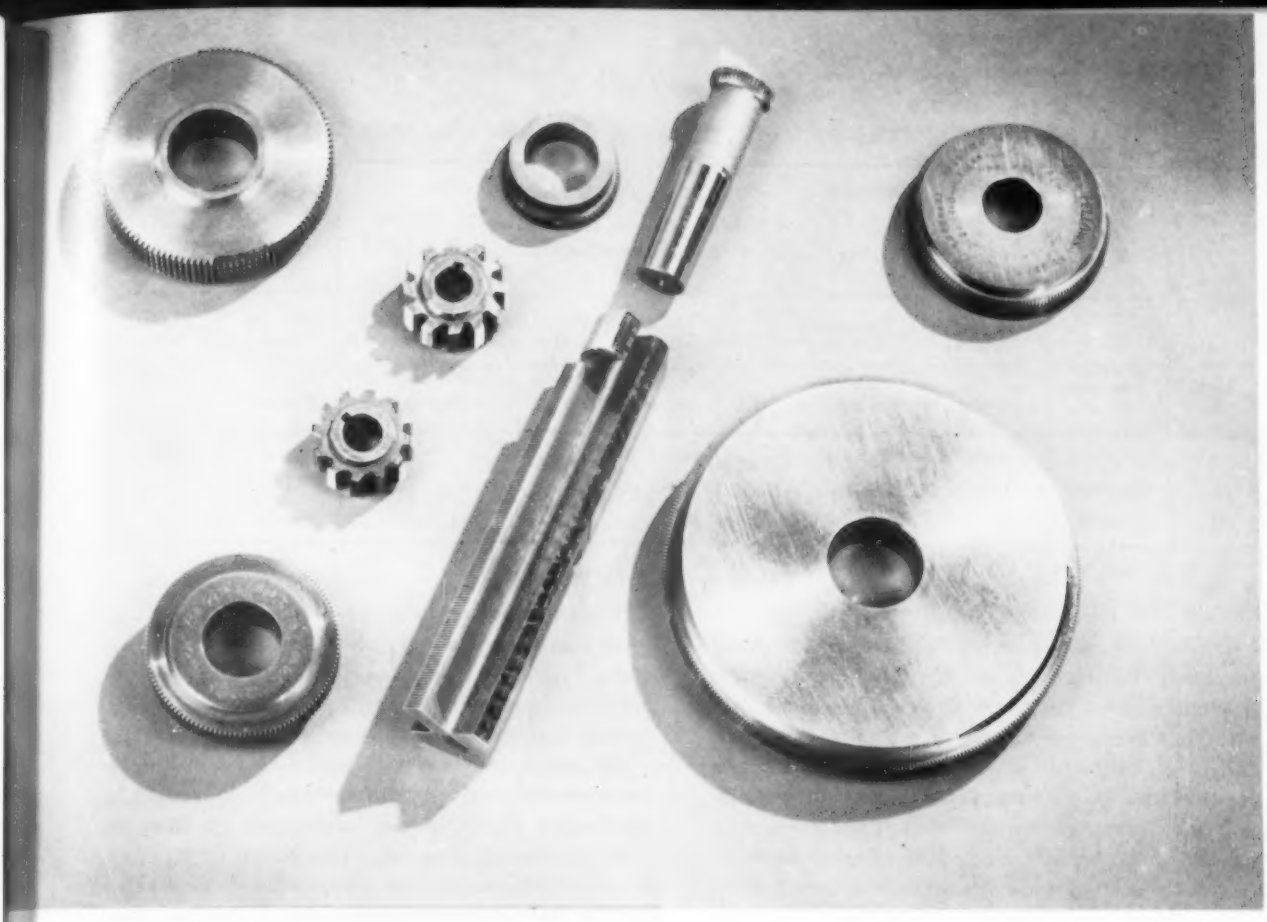


Fig. 1. Typical fine-pitch gear cutting tools and masters used for checking.

# TOOLING PROBLEMS when specifying ultrafine pitch gears

**By Louis D. Martin**

**Gear Consultant**

**Rochester, N. Y.**

**This timely discussion highlights subtle tooling considerations that are often overlooked in instrument gearing. It is a plea for realism to stem a trend that may lead to serious bottlenecks in the event of an all-out defense effort.**

THE TENDENCY toward increasing use of instrument gears with finer pitches than ever before is alarming to many tool and gear engineers. While 100 diametral pitch was considered very fine a few years ago, there are now many applications requiring gears of 160 diametral pitch and finer. Indications point toward an increasing tendency to specify even finer pitches.

The law of diminishing returns sets up a practical barrier for pitch size, beyond which greater sacrifices in quality are required than the gains in satisfying space restrictions could offset.

The design engineer justifies the use of a certain pitch, regardless of its size, on the space restrictions with which he must cope. In doing so, he often

**Table 1—Special-Case Pinions (20-Degree Involute Fine-Pitch System*)**

| | Pinion Dimensions | | Standard Center Distance System (Long and Short Addendum) Gear Dimensions | | | | Enlarged Center Distance System — Standard Mating Gear Diameter | |
|---|---|---|---|---|---|---|---|---|
| Number of Teeth ($n$) | Outside Diameter | Cir. Tooth Thickness at Standard Pitch Diameter | Decrease in Standard Outside Diameter | Cir. Tooth Thickness at Standard Pitch Diam. $\Delta t = \Delta d \tan \phi$ | Recommended Minimum No. of Teeth ($N$) | Contact Ratio $n$ Mating with ($N$) | Increase Over Standard Center Distance | Contact Ratio Two Equal Pinions |
| 7 | 9.8286 | 2.0007 | 1.1812 | 1.1409 | 42 | 1.211 | 0.5906 | 0.826 |
| 8 | 10.8738 | 1.9581 | 1.0642 | 1.1835 | 39 | 1.287 | 0.5321 | 0.929 |
| 9 | 11.8380 | 1.9155 | 0.9472 | 1.2261 | 36 | 1.357 | 0.4736 | 1.032 |

*Units are in inches based on 1 diametral pitch.

overlooks the risks taken in loss of accuracy and increased tooling difficulties. Probably, all the ramifications of tooling: its procurement, manufacture, and limited sources of supply are not generally understood. When design engineers are familiar with existing standards for fine-pitch gears, they take advantage of the smaller pinions recommended for special cases. This enables them to meet ratio and space requirements without resorting to ultrafine pitches that pose tooling and measuring problems.

One of the purposes of this article is to discuss the considerations that must be given to pitch determination in order not to rob Peter to pay Paul. Also, the advantages of special-case pinions shown in TABLE 1 from the American Standard 20-Degree Involute Fine-Pitch System, ASA B6.7-1950, will be discussed. Frequently, these special-case pinions make it possible to meet ratio and center distance requirements with coarser pitches, resulting in greater accuracy and increased tool life.

Since the accuracy of gears is dependent, to a large extent, on the accuracy that can be built into the tooling, *Fig.* 1, it may be useful to examine the relative accuracy that can be produced in gear cutters of different pitches. For the purpose of comparison, hobs and gear shaper cutters of three diametral pitches, namely: 20 DP, which is the coarsest in the fine pitch series, 100 PD and 150 DP have been chosen.

**Dimensions:** Relative sizes of hob teeth for three pitches are shown in *Fig.* 2. The point width of a 20-pitch, 20-degree pressure angle hob for

**Fig. 2. Proportions of hob teeth for 20, 100, & 160 DP, drawn to the same scale.**

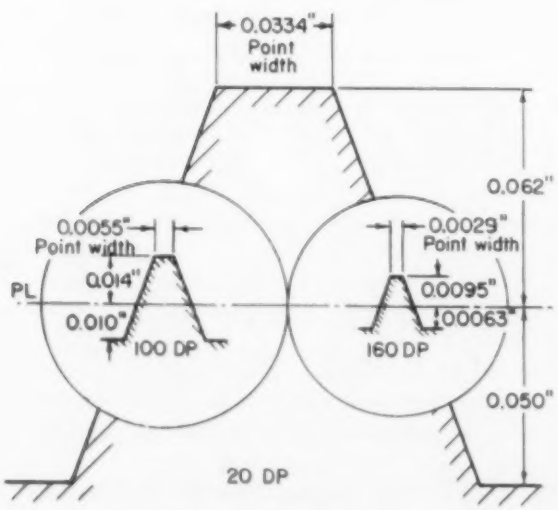
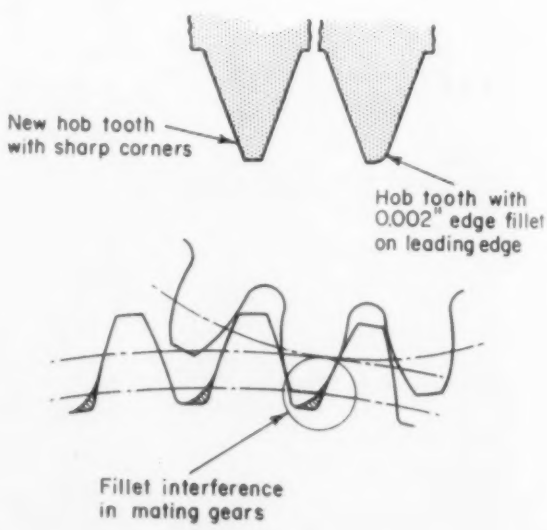



**Fig. 3. Fillet interference caused by worn hob disturbs conjugate action.**



producing gears in accordance with American Standards for 20-degree Involute Fine Pitch System is 0.0334 inch. That of a 100-pitch hob is 0.0055 and of a 160-pitch hob is only 0.0029 inch. These figures are for standard ground hobs with sharp corners. It happens that there are probably not more than two sources, in this country, for ground hobs finer than 64 diametral pitch. If the 160-pitch hob is not ground, the chances are that the point-width will be even less than the 0.0029 shown in *Fig.* 2, due to rounding off of the tips during the hardening process.

Many instrument gears are made of stainless and alloy steels. Hobs with only a 0.003-inch point width cannot last long when cutting gears of materials that have relatively poor machinability. In practice, the point on the leading edge of the hob soon breaks down when cutting hard materials. When this happens, a high fillet is generated at the root of the gear which disturbs conjugate action and causes fillet interference as shown in *Fig.* 3.

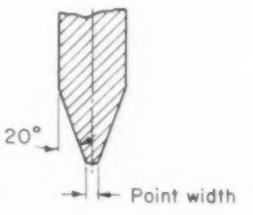
The point width of a 100-pitch hob is nearly twice as wide as that of the 160-pitch hob. When proper precautions are taken to keep 100-pitch hobs sharp, satisfactory production can be obtained.

Fine-pitch hobs are ground with a double-conical grinding wheel as shown in *Fig.* 4. The relative point widths of grinding wheels are given for hobs of 20, 100 and 160 pitch. It will be seen that at 160 pitch the wheel-point width for a topping hob is 0.005 inch. This narrow point results in wheel spring during the grinding operation. Aggravated by the speed of the hob grinding machine back-off mechanism and by the intermittent grinding action introduced by the hob gashes, the wheel flexes slightly when it comes into contact with the hob flutes. The amount of flexure is dependent on wheel rigidity and amount of stock removed. The wheel may bend slightly more on one flute than on another depending on rigidity and repeatability of the back-off mechanism. This is the reason why lead error tolerance is not diminished as the pitch becomes finer. Increased wheel flexure offsets the effects of the smaller pitch increment.

The Metal-Cutting Tool Institute's tolerance on lead variation tooth-to-tooth, is 0.0002 inch, regardless of pitch, while the lead variation in total indicator variation for one turn is 0.0004 at 20 to 29 diametral pitch and 0.0003 inch on all pitches finer than 29 DP. This disproportion of tolerance shows how the law of diminishing returns asserts itself because of practical considerations. At 20 pitch, a 0.0004-inch tolerance on lead means 0.25 percent lengthening or shortening of the linear pitch. At 100 pitch, the 0.0003 lead error is equivalent to a change of 0.95 percent and, at 160-pitch, to a change of 1.53 percent.

Lead error in a single-threaded hob, results in profile error. In a multiple-threaded hob, lead error may result in spacing error as well as profile error if the hob flutes are not equally spaced.

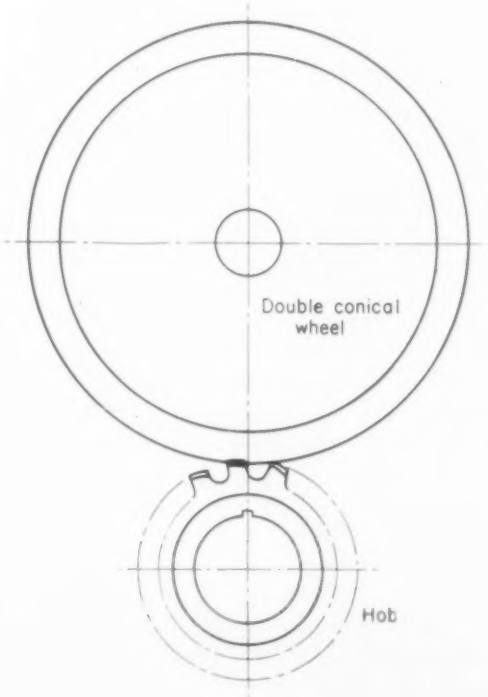
Relative pressure angle changes resulting from tolerance for hobs of the three selected pitches are shown in *Fig.* 5. The linear deviation from the theoretical shape shown is ± 0.0002 inch. The profile can be on line B-O, A-O or C-O. Since this is a linear increment the equivalent angular deviation is proportionately greater as the length of




CROSS SECTION OF WHEEL

| Gear (DP) | Wheel Point width (inch) |
|---|---|
| 20 | 0.042 |
| 100 | 0.008 |
| 160 | 0.005 |

**Fig. 4. Approximate point width of double conical wheel for grinding nontopping hobs.**



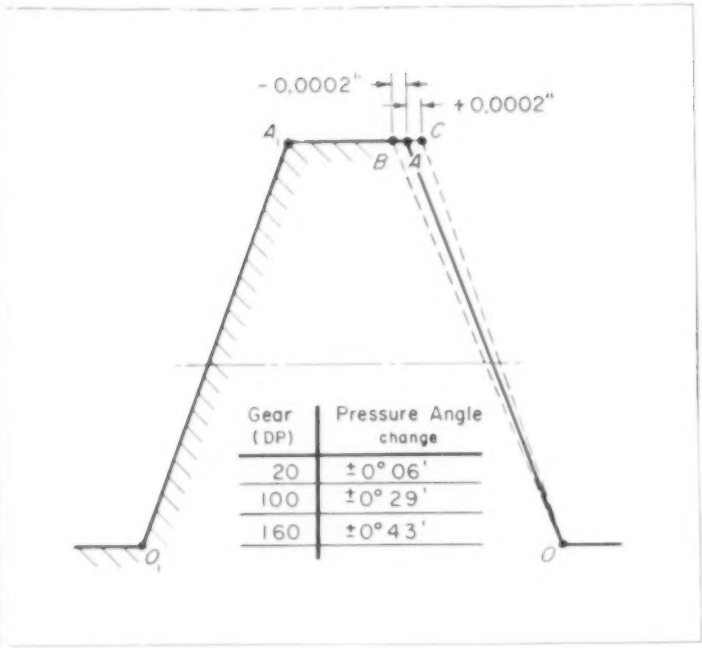



**Fig. 5. Relative pressure angle change for hobs of 20, 100 and 160 DP based on a linear deviation of ± 0.0002 inch.**

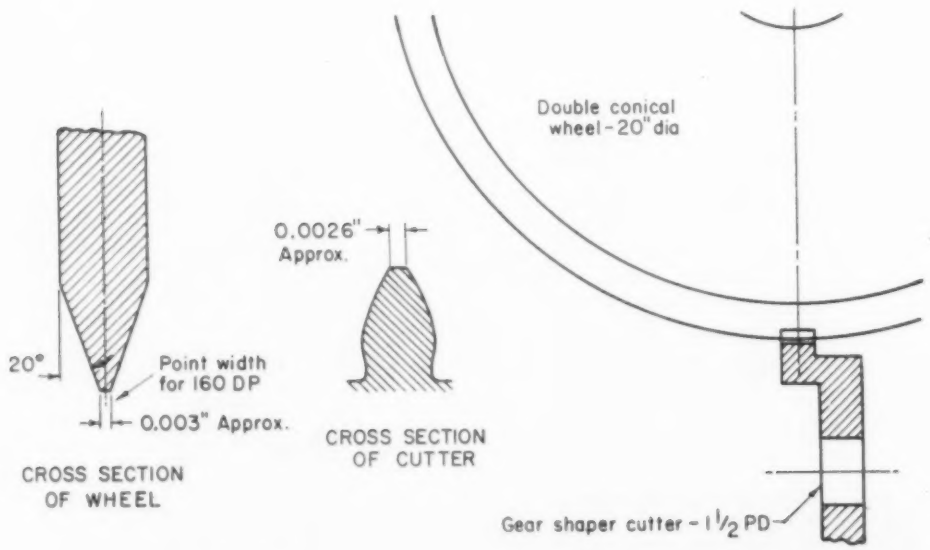
lines becomes shorter. Thus, at 20 pitch the equivalent pressure angle change is ± 6 minutes, at 100 pitch ± 29 and at 160 pitch it becomes ± 43 minutes. When the influence of lead error, as it affects profile accuracy, is superimposed on the pressure angle tolerance of the hob, it becomes obvious that the profile of the work produced by fine-pitch hobs cannot approach the accuracy of coarse-pitch hobs.

**Measurement:** There are several other factors that should be considered when comparing relative accuracy of coarse and fine-pitch tools. One is the ability to verify a measurement. Some time ago, at a symposium on measuring instruments, held by the American Gear Manufacturers Association, it was brought out that to expect verification of gear profile error measurements closer than 0.0001 inch was unreasonable. No two instruments made by different manufacturers could be expected to verify profile errors to closer measurements. This means a manufacturer of a 20 diametral pitch must have at least 0.0001 inch as a reading error. The allowance left for wheel wear, deflection, and error in a truing device is another 0.0001 inch.

At the same symposium it was brought out that gears and cutters finer than approximately 80 pitch could not be reliably checked for profile with indicating devices because the stylus becomes too flexible. At 100 pitch, for instance, the point of the tracing stylus of an involute checker could not be more than 0.004 inch thick. The indicating pressure on such a stylus would cause it to bend more than the allowable tolerance. At 160 pitch, where the point width of the stylus could be not more than 0.002, it would be impossible to make a reliable check. For this reason a profile check of fine-pitch hobs and gears is made by means of optical comparators. No manufacturer of optical comparators, however, will guarantee a measurement of tooth profile closer than ± 0.0002.

It is obvious, then, that the measurement of a profile within a tolerance of ± 0.0002 on a 160-pitch hob whose whole depth is only 0.0158 is at

**Fig. 6. Details of double-conical wheel for grinding gear shaper cutters.**



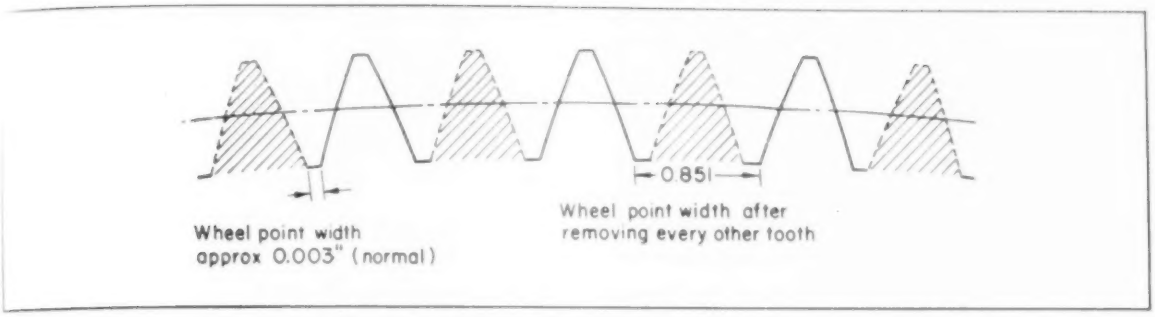



**Fig. 7. Segment of gear shaper cutter with every other tooth removed for producing 160 DP, 20-degree pressure angle gear.**

best beyond the ability of the instrument. At 100 pitch, with a whole depth of 0.024 more accurate measurements can be made.

**Gear Shapers:** Many fine-pitch gears are cut on gear shapers. There is an excellent machine on the market for shaping gears of 3-inch diameter and smaller. The cutter used on this machine is approximately 1½ inches in diameter. Cutters for this machine can only be obtained from the manufacturer of the machine. This manufacturer has developed some highly specialized and ingenious equipment for grinding the fine-pitch shaping cutters. These cutters are ground on a special machine by a double-conical grinding wheel, *Fig.* 6, approximately 20 inches in diameter.

The wheel is dressed to the correct pressure angle and represents a single tooth of a generating rack. The cutter rolls past the grinding wheel and the involute curve is generated by duplicating the action of a gear meshing a rack. The center of the wheel is set in the center of the active face of the cutter, which for 100 pitch and finer is approximately 0.200 inch as shown in *Fig.* 6. It can be seen that the curvature of the wheel leaves a slight hollow at the root and sides of the cutter teeth. This curvature, for all practical purposes, is of no consequence.

While cutters of 160 pitch and finer have been made on an experimental basis, production of appreciable quantities poses great problems. If the fragile wheel is forced too rapidly into the cutter blank, accuracy is lost. Because of this limitation, production time becomes prohibitive. Furthermore, these same grinders are also used for grinding master gears and other types of cutters.

An expedient used by cutter manufacturers to overcome point-width difficulties is to omit every other tooth from the cutter as shown in *Fig.* 7. This gives a practical wheel point width. Cutters of this type are made for cutting a gear having an odd number of teeth. When cutting gears with an even number of teeth, sections with every other tooth removed are made with recurrent sections in which two teeth are removed.

During the cutting operation the work is geared up to the cutter in the conventional manner as if it had a full complement of teeth, but the work must rotate twice in order to pick up the spot where the tooth was left out of the cutter. The chief limitations with cutters of this type are: (1) They tend to accentuate the errors of the indexing mechanism when the work makes the second revolution; and (2) production is much slower.

The same general measurement limitations apply to gear-shaper cutters and hobs. A tooth-to-tooth error allowance of 0.0002 inch is allowed at 160 pitch just as it is at 20 pitch. It should be realized that a pitch error, at 20 pitch, of 0.0002 inch is far less disturbing, motionwise, than a similar error at 100 or 160 pitch.

The effect of pitch error of a 20-diametral pitch gear, or shaper cutter, on the transmission of angular motion is shown in *Fig.* 8. The general tolerance on circular pitch of a 20 pitch gear shaper cutter is ± 0.0002 inch.

The same tolerance is required for pitch error at any pitch. This, as mentioned before, is because the cutter manufacturer cannot hold a closer tolerance. Some cutter manufacturers make special cutters with precision tolerances in which the pitch and profile error is held somewhat closer than that of a commercial cutter. These cutters are the result of painstaking workmanship and cost considerably more than commercial cutters. Precision cutters cannot be obtained in the ultrafine pitch because limited wheel point-width and deflection pose serious manufacturing problems.

The arc span of a 20-pitch cutter is 0.1571 while that of a 160-pitch cutter is 0.019648, only ⅛ as much. If the first tooth of the 160-pitch cutter is farther from, or nearer to the second tooth by 0.0002 inch, than 0.019648 it is acceptable. The same applies for tooth No. 9. Thus, through a span of 0.1572, (eight pitch increments), the 160-pitch gear can be off twice as much over a similar arc-span as the 20-pitch gear or cutter. It is understood that the ± 0.0002 error is nonaccumulative.

If the 20-pitch gear or cutter is rotated through

circular increments equal to the circular pitch of the 160-pitch gear or cutter it will be found that, all other things being equal, it will transmit angular motion approximately eight times more accurately than a 160-pitch gear of the same diameter.

One of the strong arguments in favor of fine-pitch gears over those of coarse-pitch has been the longer arc of action and the beneficial integrating effect that is obtained therefrom. This argument is valid to a certain point. When tooling and measuring difficulties outweigh the advantages gained by increased contact, the point of diminished returns has been reached.

The difficulties of producing gear shaper cutters of 160 pitch on an economical basis have been discussed. The same arguments hold true for circular master gears. Shaving tools, so necessary to achieve accuracy in precision gears, are not generally obtainable in 160 pitch. While one or two experimental shaving tools have been made in this pitch range, it is doubtful that any manufacturer would accept an order for such a tool with a full complement of teeth. Circular master gears with every other tooth removed, would also pose a checking problem. The checking operation would have to be done twice in order for the master to explore every tooth of the gear. Also, a tooth-to-tooth error could not be detected with a master having every other tooth removed.

This states the case of tooling difficulties when using ultrafine pitches. The questions might logically be asked, What is the practical limit and how fine a pitch can I use? The answer depends to some extent on the type of gears. For instance, the American Standard for Fine-Pitch Straight Bevel Gears points out: "In practice most of the fine-pitch straight bevel gears lie between 20 diametral pitch and 64 diametral pitch." Straight bevel gears finer than 64 pitch have been and are being made in spite of the problems they pose in tooling and measuring. However, careful study might disclose that a coarser, more practical pitch could be used.

There is general agreement among tool manufacturers and gear engineers that the point of diminishing returns hovers around 100-diametral pitch.

**Examples:** Values for special-case pinions having 7, 8 and 9 teeth are shown in TABLE 1. These pinions are enlarged to avoid undercut above the working depth and their outside diameters are reduced to provide a top land of approximately 0.005 inch at 100-diametrical pitch. This top land is considered practical for this pitch. All tabulated values except the number of teeth are based on one diametral pitch. For a specific gear, tabulated values are divided by the diametral pitch. Pinions made in accordance with this standard give satisfactory contact ratios when mated with a gear having the recommended minimum number of teeth.

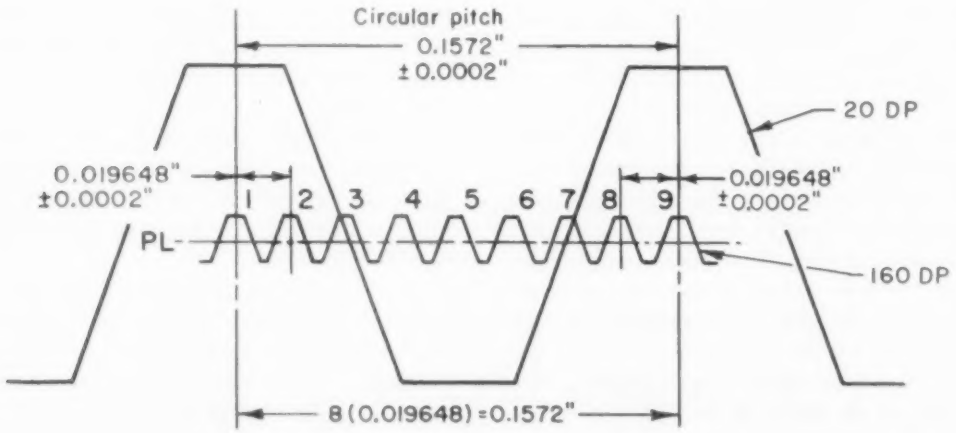



**Fig. 8. The pitch error of a 160-pitch gear or shaper cutter may be twice as great as that of a 20-pitch gear or cutter for equal circular pitch increments.**

Examination of two cases taken from recent production shows how pitch substitution will, for all practical purposes, satisfy the design conditions.

Specifications for Case 1 involving substitution of a 100-diametral pitch gear set for one of 160 pitch are listed in TABLE 2. The difference in contact ratio between the 100 and 160-diametral pitch combination is negligible. The difference in center distance is 0.0065 inch, the 160-pitch combination having slightly closer centers. It would have been possible to meet the exact center distance require-

**Table 2—Substitution of Gear Sets with 9 to 1 Ratios**

| Part | | Diametral Pitch Combination | | | |
|---|---|---|---|---|---|
| | | 160 | | 100 | |
| | | Gear | Pinion | Gear | Pinion |
| Teeth | (no.) | 99 | 11 | 63 | 7 |
| Std. PD | (in.) | 0.61875 | 0.06875 | 0.630 | 0.070 |
| Operating PD | (in.) | 0.614 | 0.0735 | 0.618 | 0.082 |
| Outside Diam. | (in.) | 0.626 | 0.086 | 0.641 | 0.0983 |
| Pressure Angle | (deg.) | 20 | | 20 | |
| Center Distance | (in.) | 0.330 | | 0.3437 | |
| Mean Contact Ratio | | 1.362 | | 1.389 | |

**Table 3—Substitution of Gear Sets with 10 to 1 Ratios**

| Part | | Diametral Pitch Combination | | | |
|---|---|---|---|---|---|
| | | 150 | | 100 | |
| | | Gear | Pinion | Gear | Pinion |
| Teeth | (no.) | 12 | 120 | 80 | 8 |
| Std. PD | (in.) | 0.800 | 0.080 | 0.800 | 0.080 |
| Operating PD | (in.) | 0.796 | 0.084 | 0.7894 | 0.0905 |
| Outside Diam. | (in.) | 0.8093 | 0.0974 | 0.809 | 0.1087 |
| Pressure Angle | (deg.) | 20 | | 20 | |
| Center Distance | (in.) | 0.440 | | 0.440 | |
| Mean Contact Ratio | | 1.528 | | 1.305 | |

ments of 0.3437 inch specified for the 160-diametral pitch set of gears, with the 100-pitch gears by reducing the gear and using standard proportions (not enlarged) on the pinion. This would have resulted in a slightly lower contact ratio and weaker pinion.

Case No. 2 shown in TABLE 3 illustrates another example of how a 150-pitch gear set was replaced by 100-pitch with perfectly satisfactory result. In fact, the 100-pitch gears ran more smoothly and lasted considerably longer than the 150-pitch set.

In this case, it was possible to meet the exact center distance requirements. The difference in contact ratio, at first glance, would seem appreciable. Actually, it is only 17 percent which is not an important difference especially when it is considered that a reduction in outside diameter in the finer pitches affects their contact ratio much more than an equivalent reduction for coarser pitches.

There has been too much emphasis placed on the importance of having as large a contact ratio as possible. The beneficial integrating effect of a high contact ratio is cited as an important consideration. In the first place, there is less need to integrate out the errors if they are reduced during production, which is the case when coarser pitches are used. Secondly, a contact ratio in fine-pitch spur gears beyond that which insures continuous action (somewhere between 25 and 30 percent more than one base pitch) is useless. It is conductive to premature wear in highly stressed high-speed gears. Many cases of increased gear life are on record where nothing was done to the gear sets other than to reduce their contact ratios. In motion drives where optimum angular transmission is desirable, the requirements are different. In such slow moving drives a high contact ratio is desirable. Drives of this kind must be as accurate as possible in all respects and the inherent accuracy limitations of the ultrafine pitches will not satisfy the operating requirements.

The two cases cited as examples, where 100-pitch gears were substituted for finer pitches with satisfactory results, can be multiplied many times. It is not claimed that all designs can be made to respond to the same treatment. There are no doubt many designs in which the ultrafine pitches cannot be avoided.

In the event of a national emergency there would be an appalling dearth of equipment for producing cutters finer than 100 pitch. If the present trend to specify ultrafine pitches continues, it is conceivable that the tool procurement problem will be compounded and may affect our national security. The law of diminishing returns should be given the consideration it deserves.

# "Sound" Checking

RELATIONSHIP OF SOUND to burnishing operations has been utilized to both increase accuracy and save scrap in a setup at Minneapolis-Honeywell's aeronautical division.

Working with the knowledge that there is a direct correlation between sound from the burnishing wheel and the amount of metal removed, Ted Minor, a methods engineer, furnished the idea of expanding this sound through a microphone, amplifier and earphones or speaker. This arrangement, tied in with an electronic comparator, now permits the operator to check dimension to an accuracy of 5 millionths of an inch.

Consequences have been reduced scrap loss by minimizing "over shooting" of the tolerance point and lessened operator fatigue since the operator can monitor the work while in a normal, comfortable position. The worker formerly was prone to lean over his machine to "hear" how much metal was being removed.

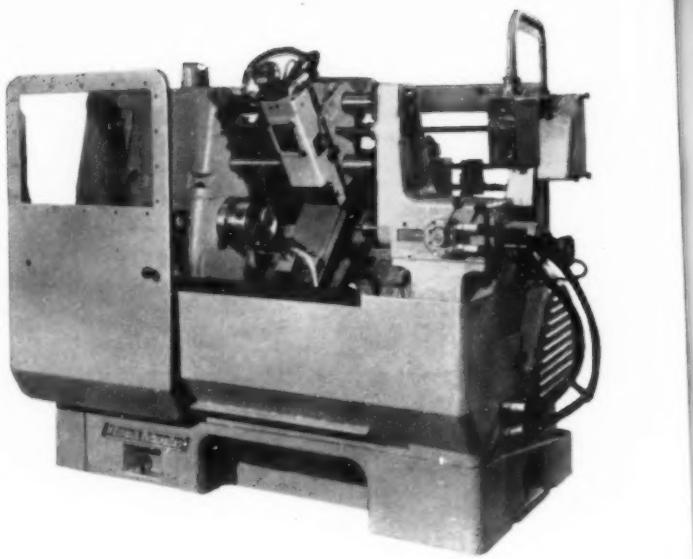


Fig. 1. The Pilote contour lathe features hydraulic feed for all major machining operations. The splash guard is mounted on rollers for ease of handling.

# AUTOMATIC COPYING LATHE

## operates with hydraulic feeds

MODERN TRENDS in European machine tool design toward automatic operation and hydraulic feed are embodied in the recently developed automatic copying lathe, *Fig.* 1. It is basically a single-spindle copying lathe that controls cutting through a copying device that requires no guidance by the operator. The operator merely loads the machine and pushes a button to start the cycle. When the part is finished, the tool returns to its starting position and the spindle is braked to a stop.

One of the most important features of the Pilote lathe, developed in France by H. Ernault Batignolles and represented by H.E.B. Machine Tools, Inc., New York, N. Y., is its extensive use of hydraulic power. The longitudinal carriage, tailstock, copying device, infeed attachments and sometimes the chuck are hydraulically powered. To assure accuracy and good finish, the hydraulic circuits are designed so feed per spindle revolution remains constant as set regardless of resistance met by the cutting tool, and changes in temperature, oil viscosity and spindle speed.

The machine has all the advantages of any single-spindle automatic lathe and in addition the setup can be completely changed in less than one hour. Through proper tooling, roughing and finishing may be carried out at the same time. Also, both boring and outside turning can be done at the same time. The machine is equally suited for first or second operations and can replace chucking machines for many purposes.

Although the machining time of this basically single-tool machine is frequently only slightly less for a specific job compared with multitool lathes, savings in setup time, tooling costs and down time for tool replacement can be considerable. This lathe can do jobs now done on multitool lathes, frequently without the need for finish grinding.

For a number of years the trend was toward adding more tools and more horsepower to machines but frequently the time required for tool changes reduced the total output of the machine.

Roughly triangular in cross-section, a one-piece casting forms the base and bed of the lathe, and imparts rigidity to the structure. The ways are hardened and ground nitrided-steel inserts, screwed and dowelled in position. Lubrication of the ways and cross-slide is achieved through controlled seepage from the hydraulic system. Apart from inherent rigidity of its triangular shape, the inclined bed assures good chip clearance.

Because of its rigidity and its controlled movements, the lathe is capable of regularly producing surface finishes of better than 32 microinches (rms). In demonstrations, a finish of 8 microinches (rms) has been achieved. In addition to better finish and increased accuracy made possible by freedom from vibration, this same characteristic permits increasing cutting speeds 20 percent without loss of tool life.

Transverse movement of the tool block is effected by a live hydraulic copying device activated by a tracer following a templet. The designers feel that at the present time a hydraulic system offers the

best and simplest method for moving the tool post at any speed and with any acceleration or deceleration. Although H.E.B. has an electronically controlled copying lathe in experimental operation, they feel the hydraulic method is presently superior.

Heart of the copying device is a vertical piston rigidly attached to the cross-slide. Oil pressure is varied on both sides of the piston by oil metered from the cylinder by the tracer-actuated valve. Since the two sides of the piston differ in area, equilibrium is achieved when the variable-side pressure is half that of the other side. Thus there is considerable valve opening at equilibrium and any slight change in the valve opening, because of tracer movement, causes an instantaneous tool response. This differential pressure system is much more sensitive than systems having a closed valve at equilibrium.

Square shoulders can be copied easily with this lathe. As the tracer hits a shoulder on the templet, it is deflected to the right and closes a precision limit switch. In the normal copying condition, a solenoid at the end of the feed shaft is energized. When the limit switch is actuated, this solenoid is de-energized, declutching the feed shaft, and a second solenoid is energized to close the hydraulic valve in the copying device. This causes the tracer and the tool to withdraw forward.

Although the slight lag in operation of electrical switches prohibits their use in highly sensitive copying devices for the control of transverse motion, they are satisfactory for controlling longitudinal motion. H.E.B. engineers will guarantee diameters to within ± 0.0004 inch with the hydraulic copying device of this lathe, but would gaurantee no more than 0.003 inch if an electrical system were used. The Pilote maintains tolerances of 0.0015 inch on axial lengths at feed rates up to 16 inches per minute. Greater accuracy can be achieved by reducing the feed. Copying feed can be reduced during a cut by positioning stops to operate precision limit switches. The ratio of reduction is 2.5 to 1. There are 22 basic feeds possible ranging from 0.0035 to 0.035 inch. Feed and carriage return rates of 27 fpm reduce idle time.

Capabilities of the lathe have been broadened by the use of an indexing type templet carrier, *Fig.* 2, whose rotation is automatically controlled by the carriage motion. The drum carrier contains space for eight hardened flat templets and can thus produce on a cycle requiring up to eight cuts.

The indexing mechanism comprises a small motor and a cam drum controlled by stops and limit switches. Speed of rotation of the cam drum is controlled by pick-off gears.

The desire for a lathe with an automatic cycle without complicated mechanical or electrical attachments led to the use of a hydraulic drive for the carriage longitudinal feed. To use a hydraulic feed, inherent defects of such systems had to be remedied. Development of a piloting device, *Fig.* 3, overcame the possibility of nonconstant feed. The Pilote lathe is equipped with a piston and a pilot screw, similar to a lead screw, the motion of which is dependent on that of the spindle. The screw meshes with a locked pinion, taking the place of a nut, which is attached to the carriage.

The pilot screw is free to move axially but one end is in constant contact with the oil control valve. This valve controls the admission of oil under pressure to the cylinder. As long as the carriage moves at a constant speed, in relation to the spindle speed, the pilot screw will turn through the pinion. If the carriage speed does not remain constant, the pinion will drag or push the pilot screw axially, which will increase or decrease the valve opening. This mechanism can be thought of as a copying device with the pinion acting as a tracer and the pilot screw as the templet.

A major consideration in the design of copying lathes is provision for cutting square shoulders or tapers having more than 90 degrees included angle. This means that the tool must feed out rapidly in relation to its longitudinal movement. A common method of overcoming this difficulty is to fit the copying mechanism and tool to a slide inclined at an angle of 45 or 60 degrees to the axis of the machine. Shoulders are thus machined by a differential action of the longitudinal feed of the carriage and the traverse of the inclined slide.

When carbide tipped tools are used, it is essential that vibration be minimized. One source of vibration is the sliding surfaces interposed between the tool and the main body of the machine. This lathe

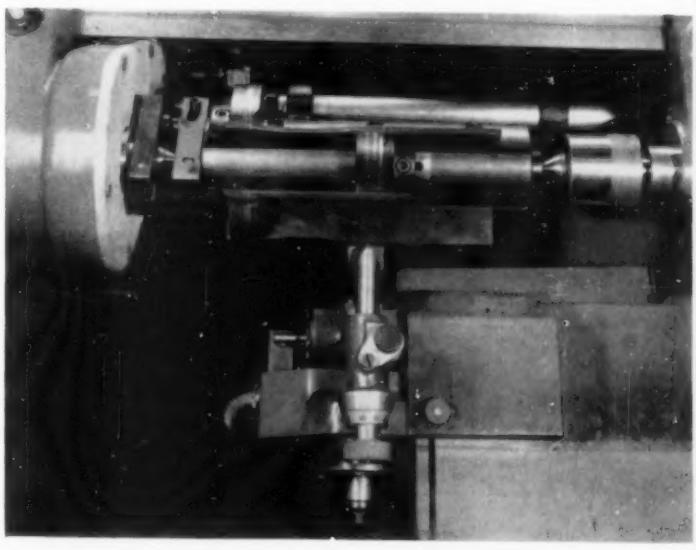


**Fig. 2. Heart of the copying device is a tracer that follows any of eight templets in a prescribed order.**

has the cross-slide positioned at 90 degrees to the bed, and there are only two sliding motions between the bed of the machine and the cutting tool.

Another limitation introduced by an inclined slide is that while the angle which the tracer can climb is increased, the angle which it can descend is reduced by an equal amount. It is frequently desirable to copy turn a portion of a part and machine the rest by conventional methods. With an inclined slide, this is difficult if not impossible. On the Pilote, recesses and narrow undercuts can easily and accurately be machined by ordinary methods.

Rear tools are frequently useful when machining workpieces but they cannot generally be applied to inclined slides. Where they can be used, they are usually limited to straight transverse motion. The lathe can have rear tools mounted for conventional machining and copy turning.

A machine with an inclined slide frequently has trouble with coolant leaking through the slides and into the hydraulic system. Such contamination is avoided with the slide at 90 degrees to the axis of the machine. An ample flow of coolant is available on the Pilote and the splash guard is effective so the flow need not be restricted. Coolant emerges from a nozzle fitted to the front tool block.

The front copying tool is mounted tangentially to the work and is in compression. This avoids the vibration normally encountered with an overhanging radial tool and uses the carbide in its strongest attitude. Wear on the tip of a horizontal tool is in the direction of minimum thickness and the number of regrinds possible is less than with a vertical tool.

A patented stop at the front of the tool slide is micrometrically adjusted so that a particular diameter can be duplicated within close tolerances. The rear tool is used for finish turning these diameters and the standard hydraulic carriage feed is used. Production tolerances of ± 0.0002 inch can be maintained through use of this mechanical stop.

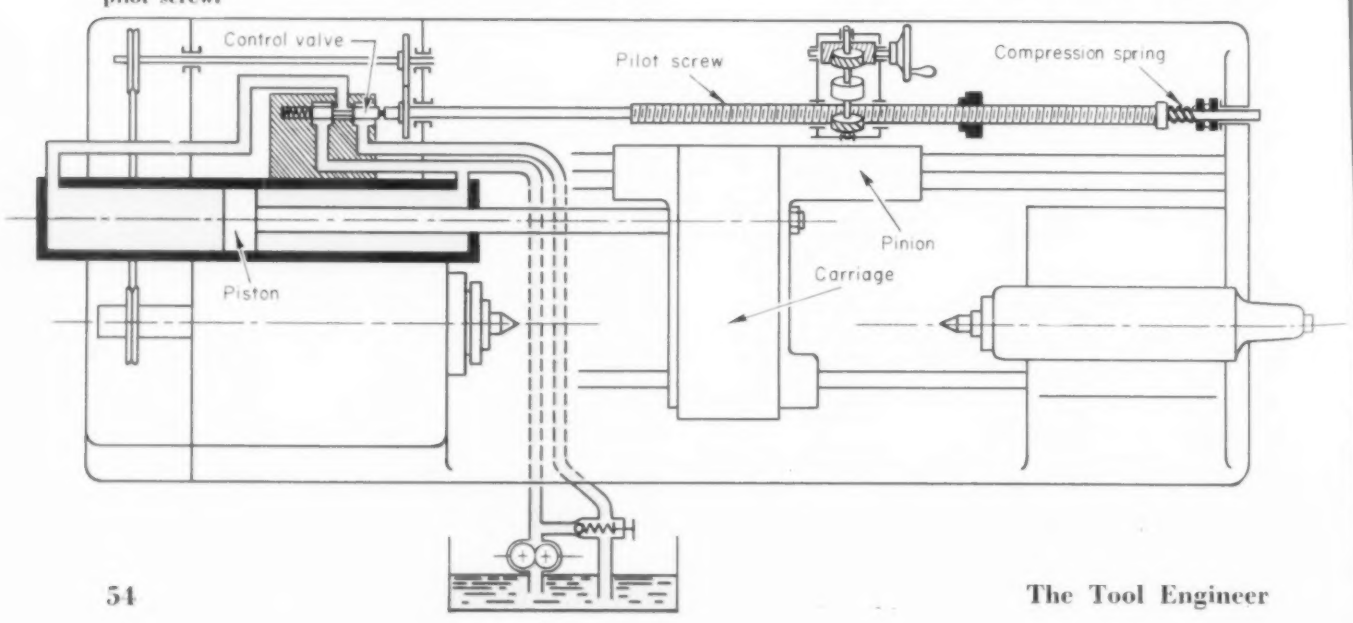
The motor is mounted in the base of the machine with connection to the gearbox through seven V-belts. Spindle speeds are varied by changing pick-off gears and there are ten spindle speeds between 380 and 3000 rpm with a progression rate of approximately 1.27. Pick-off gears are used in the main drive because they enable less gears to be used than would be necessary with a quick-change gearbox. This results in high efficiency and low vibration.

When planning the work cycle for this lathe, as much work as possible is assigned to the front tool. Because of its vertical mounting, it is more rigid than the overhung back tool and it can take heavier cuts. There are contours that cannot be duplicated by a single tool, and there are instances when the work cycle can be shortened through application of additional tools. In such cases, copying of deep outlines and fine details are handled by the additional tools.

The front and back tools can both be used for copy turning, using a different templet for each cut. The back tools can also be arranged for automatic plunge cutting. Back tools are operated hydraulically by simple cams forming part of the templet carrier.

The lathe can be equipped with two independent cross slides, each having its own copying device. This can result in extremely short cycles because two tools working simultaneously can reproduce a single workpiece. When additional tooling is required, several vertical tool slides can be used. These operate as part of the automatic cycle and enable undercuts and grooves to be cut without any increase in the machining time.

**Fig. 3. Difficulties inherent in hydraulic systems have been controlled on this lathe by inserting a pilot screw to maintain constant relations between carriage speeds and spindle speeds. No force is transmitted through the pilot screw.**



# MULTIPLE DRILLING in the Turret Lathe

By Clifford T. Bower

London, England

PRODUCTION ADVANTAGES can be gained by completely machining a component in one machine. There is no need for handling and storing partially finished parts between machines and there is thus no chance for damage in transit or during storage. Output is steadier and scheduling can be more exact. When two machining operations, such as turning and drilling, can be completed on one machine, a second machine and operator are avoided so that production costs can be reduced.

To have a machine perform a function other than that for which it was designed, attachments and special tooling must be provided. Generally, the cost of such attachments is greater than for jigs and fixtures that would be used on a second standard machine. Multiple drilling on a turret lathe, for example, requires a rather elaborate drilling head. When a production run is long, the additional expense of the drilling head can usually be justified economically. A stock multiple drilling head and a suitable work-holding fixture would be required if the operations were to be performed on separate machines. When the expense of these otherwise necessary items is deducted from the cost of the special drill head for the lathe, the excess expense is small and can be worked off quickly because of previously mentioned advantages.

The electric motor end cover, shown as the workpiece in *Fig.* 1, is a typical engineering component that lends itself to complete machining in a turret lathe. Standard equipment of the lathe is augmented by a special multiple drill head and the end plate is turned and drilled on one machine. The finished end cover casting has a large diameter with a shallow recess machined in its rim and a concentric bore placed in its axial hub. Four equally spaced ¼-in. holes are drilled in bosses provided for that purpose in the casting. Equipment for drilling these holes on a turret lathe will be described.

Four drilling spindles are axially grouped around the centerline of the attachment that is mounted in one of the tool holes in the lathe turret. Power for driving the drilling spindles is derived from the lathe headstock spindle. With such an arrangement, the headstock spindle rotates and carries with it the multiple drilling head, while the drills are fed into the work by the normal turret traversing mechanism.

Connection between the drill head and the lathe spindle is through a guide bushing that is force fitted in the central hole of a four-jaw self-centering chuck. The guide bushing supports a pilot bar that is used with some of the turning tools and which runs the full length of the drilling head. The pilot bar is supported at its right end in a bearing placed in one of the tool holes in the turret.

When the chuck rotates, the pilot bar is carried with it because of a key connection between the bar and the guide bushing. Since just one key is used, the bar is always in the same radial position in relation to the work.

Mounted on and keyed to the pilot bar with a sliding fit, the guide bushing plate carries four hardened guide bushings for supporting the drills close to the bosses. The guide bushing plate is de-

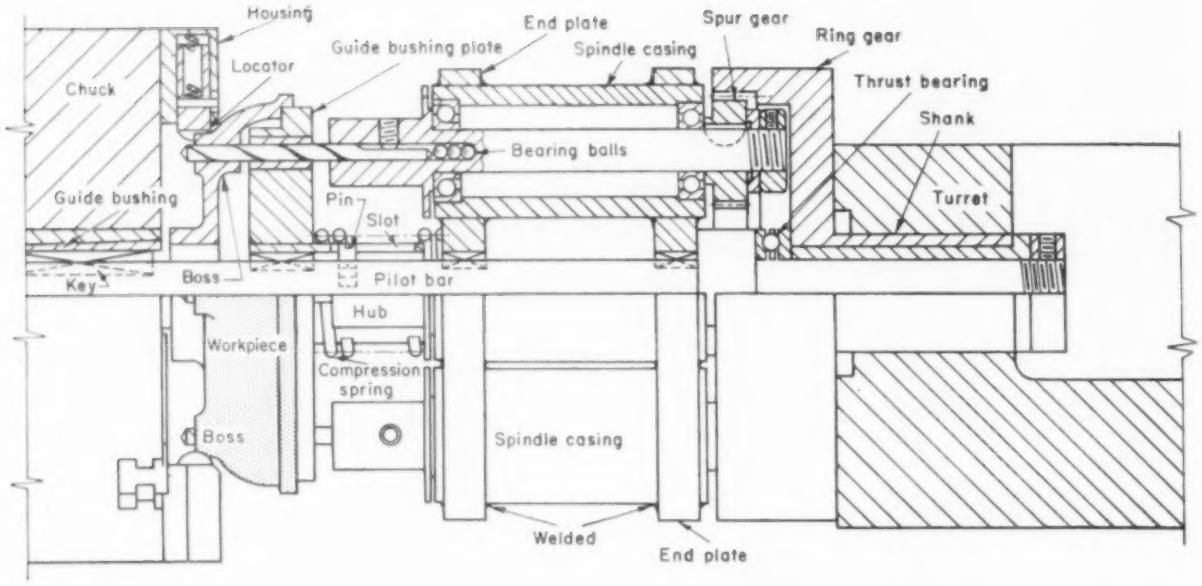



**Fig. 1. Power for driving the spindles of this drill head is supplied by the headstock spindle of a standard turret lathe. Through use of this attachment motor end covers were turned and drilled on a single machine.**

signed to fit into the recess machined in the rim of the motor end plate and is pushed into engagement with it by a compression spring. This spring slides on the hub that is integral with the guide bushing plate. An elongated slot is machined through the wall of the hub, in which a pin is free to slide. The pin, tapped into the pilot bar, prevents the guide bushing plate from being pushed too far to the left when the drilling attachment is not in use.

Each of the four drilling spindles is housed in a steel tube casing. The four casings were welded to a pair of disk-shaped end plates and machined as a unit. This body unit is keyed to and revolves with the pilot shaft to ensure that the drilling spindles are accurately positioned.

Since the drill head was designed for machining only one component, the drill spindles are of simple construction. They each have a straight axial hole in which the plain shank of a $\frac{1}{4}$-in. drill fits. Flats are ground on the drill shanks and the drills are held in place by setscrews. Axial thrust of each drill is taken by an adjustable end packing that comprises several ordinary bearing balls placed in the drill mounting hole.

When new drills are fitted to the head, their ends abut against the bottoms of the drill mounting holes and their cutting ends lie in one vertical plane. Continued resharpening shortens the drills and bearing balls are dropped in the holes to ensure drilling through the cover bosses. The balls are slightly smaller than the drills so that drill point positions can be maintained within $\frac{1}{4}$-in. of the ideal position.

Since the workpiece and the drill head rotate together, some method had to be devised to rotate the drills independently of the drill head. Each drill spindle carries a small diameter spur gear at its right end and the four spur gears mesh with an internal ring gear fixed in the turret. When the drill head rotates, the spur gears run around the internal gear in a planetary fashion, rotating the drills at high speed.

Integral with the fixed gear is a plain shank that fits into the turret tool hole. It is locked in place by the regular bolt. The inside bore of this shank carries a bronze bushing that supports the right end of the pilot bar. The bar is retained axially in the bushing by a collar so that endwise adjustments can be made. Since the turret feed causes a thrust on the pilot bar, a ball thrust bearing is installed to reduce friction.

The radial positions of the drills are fixed in relation to the chuck so workpieces must be properly loaded to position the bosses in relation to the drills. To control the radial position of the motor end plates when they are mounted in the chuck, a pair of V-shaped locators, *Fig.* 2, are secured on a radial line across the face of the chuck. The locators comprise a cylindrical plug with a V machined across one end and sliding in a housing. Each locator is spring loaded toward the center and is restrained from dropping out of the housing by a cross pin sliding in an elongated slot.

When a workpiece is loaded into the chuck the outside surfaces of two opposite bosses are engaged by the locators. Should the opposed bosses be off center (so that a line intersecting their centers is

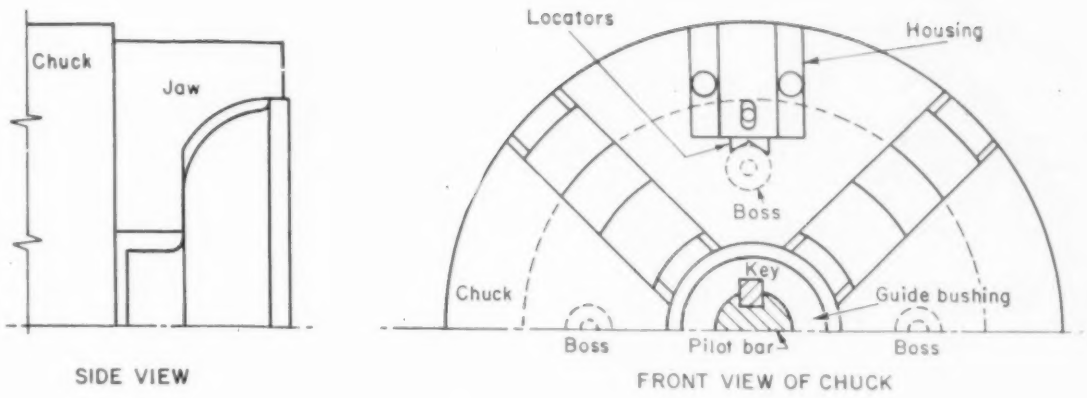



**Fig. 2. Method of locating the bosses is shown in this diagram. The locators were easily positioned because a four-jaw chuck was used.**

offset from the diametral line of the component exterior), the locators maintain the boss centerline parallel with that of the chuck. This has the effect of sharing the boss material evenly, in a manner similar to that which would be obtained by marking the component on a surface plate.

A four-jaw self-centering chuck was chosen for holding the components for two reasons. The pressure of the jaws on thin castings must not be heavy and light pressure from four jaws gives a better hold because of greater jaw surface in contact with the workpiece. The positioning of the locators was facilitated by using four jaws instead of three.

In use, the drill head is indexed into position by the turret and the pilot bar is engaged with the keyway in the chuck guide bushing. The lathe spindle is started and the turret fed axially so the guide bushing plate engages the machined rim of the motor end plate. The drills advance through the guide bushing and the bosses. The spindle of the lathe is stopped when backing out the pilot bar in order to disengage the keyway.

This type of drill head has been successfully used in drilling bolt holes in the flanges of T-shaped pipe connectors, as well as for motor end covers. There are many other applications of this basic approach that will enable complete machining of parts on a turret lathe or other single machine.

# Steel Parts by Cold Extrusion

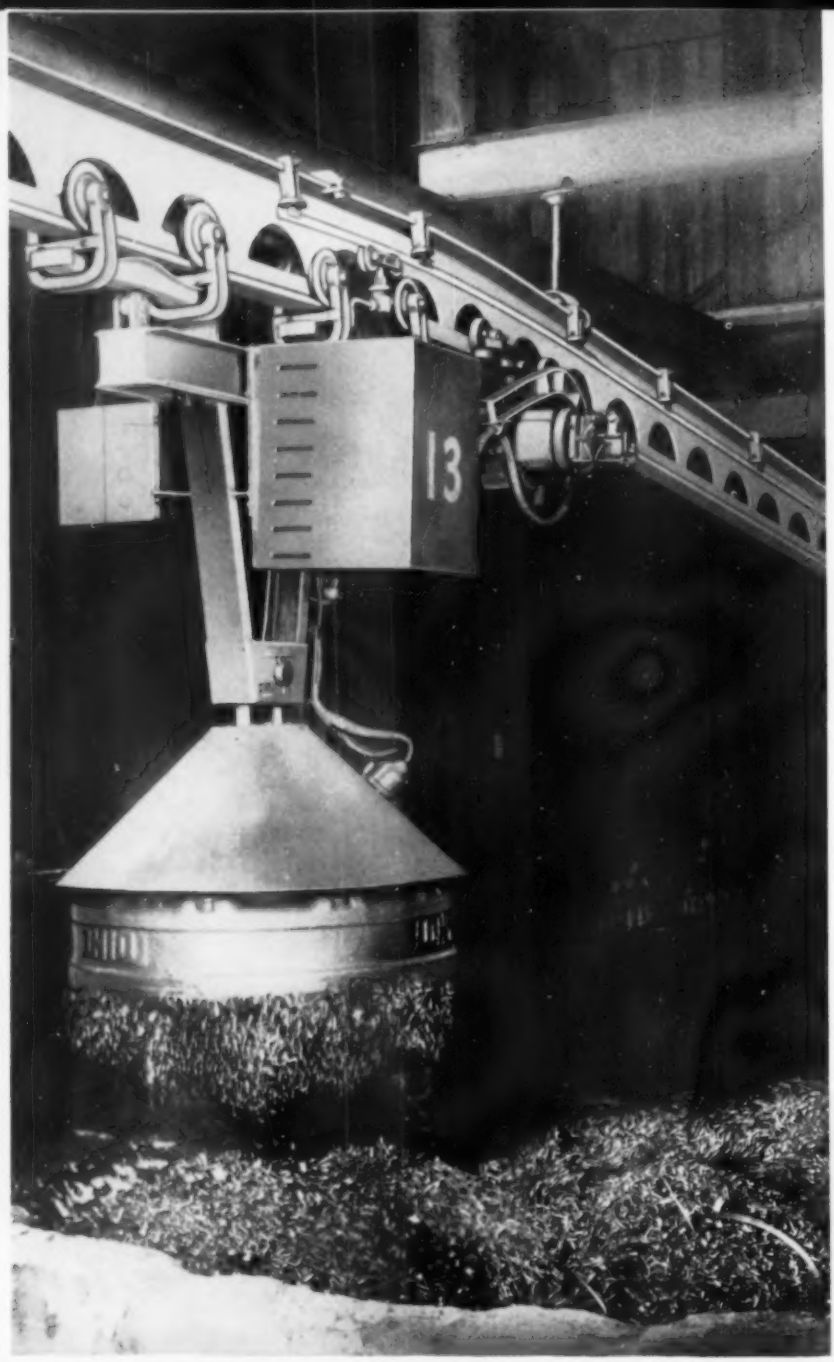
PERFECTION OF a process of cold extrusion of steel has been the culmination of seven years of research. Information on the subject has been made known by Heintz Manufacturing Co. who were directed toward the work after it was found during World War II that the Germans were successfully extruding common steel.

By use of heavy cold forming methods, two or three items can be produced from the raw material formerly required for one. The tremendous saving in steel is demonstrated by current statistics: a 75 mm shell weighing 8.9 pounds is formed from a billet weighing 9.22 pounds, a loss of only 3.4 percent; a 120 mm shell weighing 42.13 pounds is extruded from a billet 43.3 pounds, or a loss of only 2.7 percent.

According to the experimenters, a high explosive shell as big as 75 mm has been made by cold pressed methods, and shell bodies, rocket heads and other components for ordnance and commercial work are now "squeezed" out of common steel. This steel, which is identified as that containing less than a heat-treatable quantity of carbon, develops far higher strength characteristics in the finished product than those made conventionally of high carbon steel machined or hot forged and heat treated.

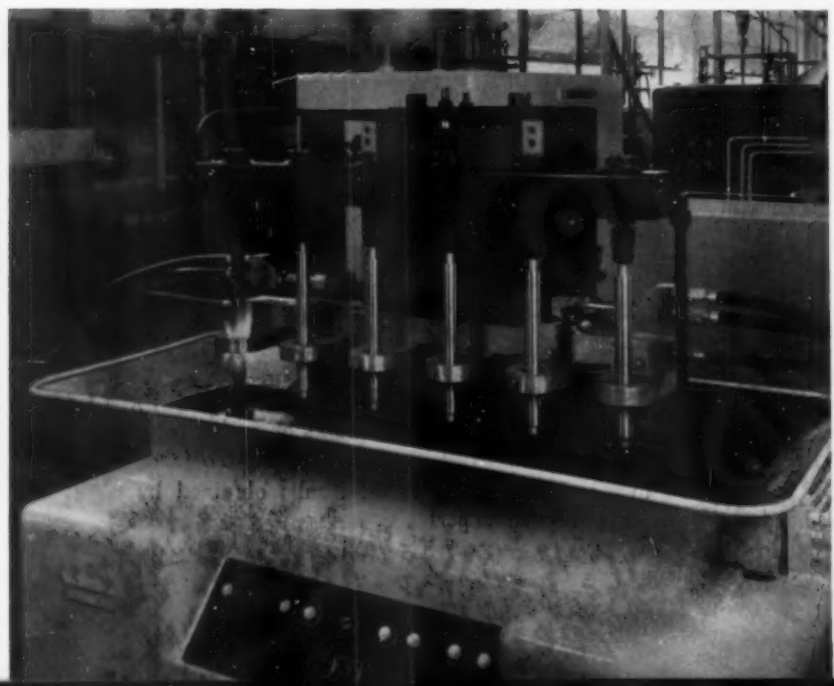
A special lubricant developed by Heinz research laboratories, enables pressure up to 200 tons psi to be applied to the steel without wiping out the lubricant. Steel flows, almost as if it were molten, past two surfaces and remains sound and structurally solid.

As for the effect on tool life, during experiments, one punch produced 289,433 pieces or rocket head bodies. This represents an improved tool life of 15 to 30 times over the best results obtained by earlier European experience.

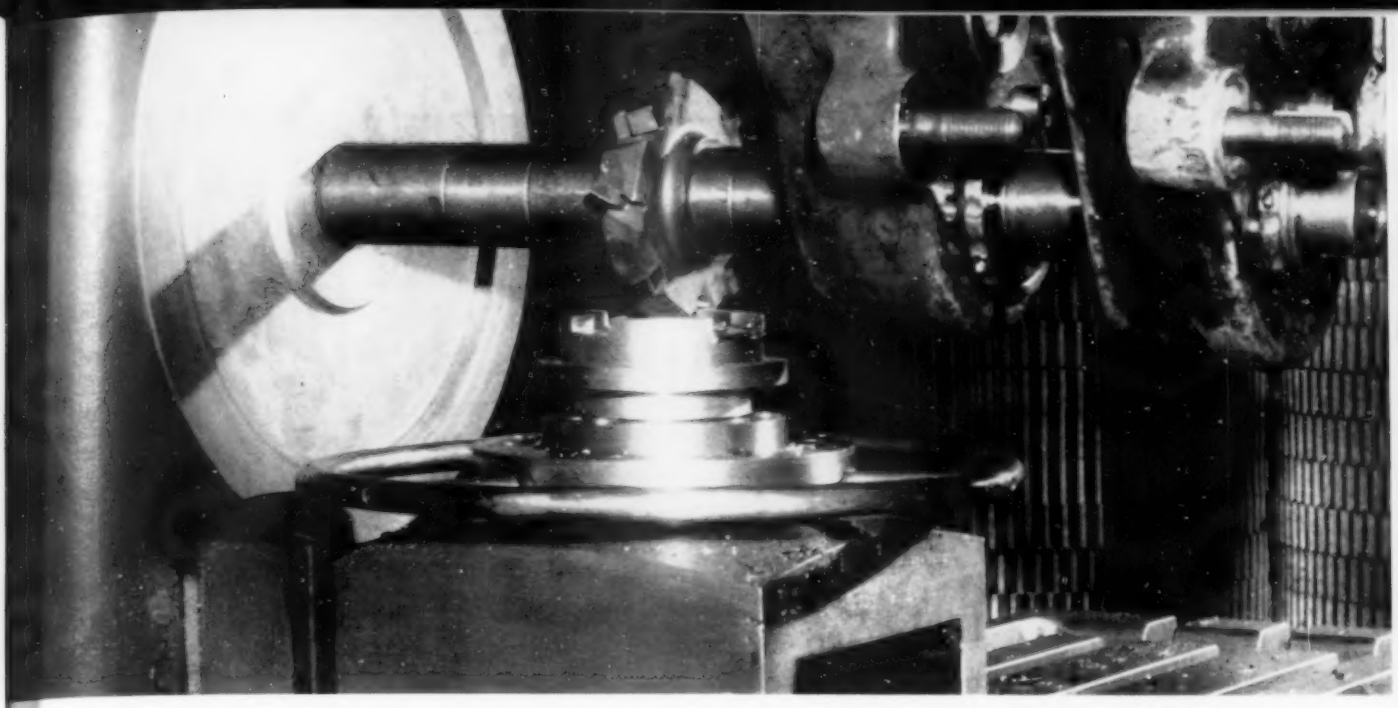



AUTOMATIC SCRAP-GATHERING magnet about to dump a load into disposal bin. The system, engineered and built by Cleveland Crane & Engineering Co., operates without attendants. Scrap from metal-working machines empties through chutes into two tunnels in the basement. Tram-rail magnets in each pick up the scrap while traversing the tunnels. Current is automatically switched off to drop the load and on when magnet returns to starting point.

# TOOLS at work



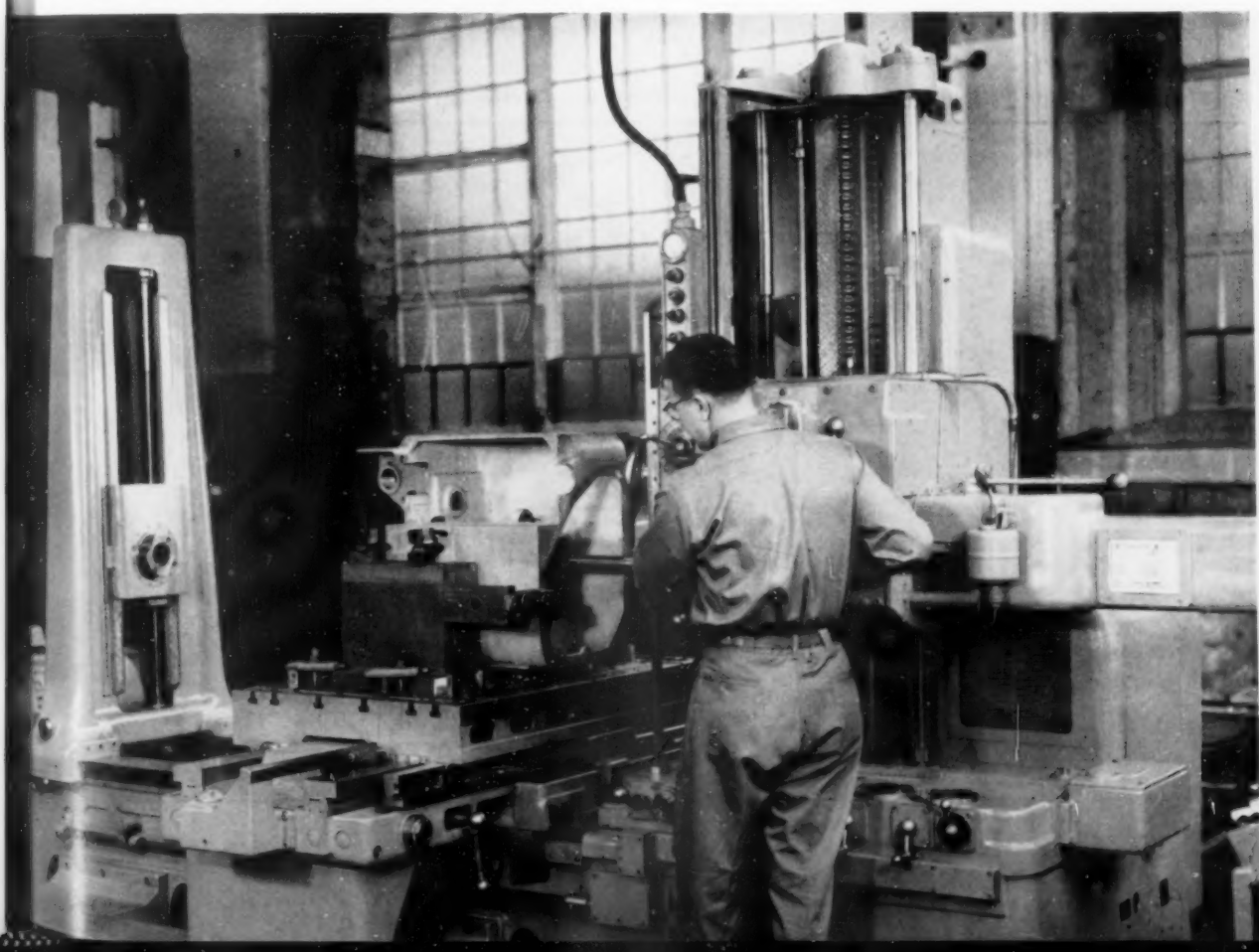
AUTOMATIC FLAME HARDENING SAE 1045 air cylinder piston rods to 60 Rockwell C in Cincinnati Milling Machine Co. Flamatic. Burner and quench heads move vertically while the workpieces rotate. Only hand operation is loading and unloading. Fuel gas and oxygen are metered by the power control unit in the background, regulating heat input. Water pressure for cooling and quenching, as well as air for actuating cylinders and electrical power for automatic cycling are similarly controlled.



PRODUCTION WAS QUADRUPLED at Ernest Holmes Co., Chattanooga, Tenn., by drastic revision of setup for milling lugs on SAE 4140 steel clutch. Staggered-tooth tungsten carbide cutters replaced HSS slotting mills. A 14½-inch flywheel was installed on the arbor to assure smooth power flow. Depth of cut remains at 5/16 inch but feed rate was increased from 3⅜ to 20 inches; speed was increased from 80 to 583 sfm, reducing milling time from 17 to 4.1 minutes.

*Photo courtesy Kennametal, Inc.*

BORING OPERATION on close grain cast iron for complex gear housing of a machine tool at the Giddings & Lewis plant in Fond du Lac, Wis. In all, 43 separate operations, including drilling, boring, reaming, face and contour milling, are performed on the part by this G & L horizontal, model 300 T. An automatic positioning device facilitates boring.



# SPAR MILL profile template design

**By James M. Stolz***

**Opto Engineering Co.**
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EACH MAKE of spar milling machines requires its own type of profile templets to guide the cutter in producing the contour of the various spars used in aircraft. Some of the different profile templets involve particularly difficult problems. One instance arises in using compound motion for spar milling.

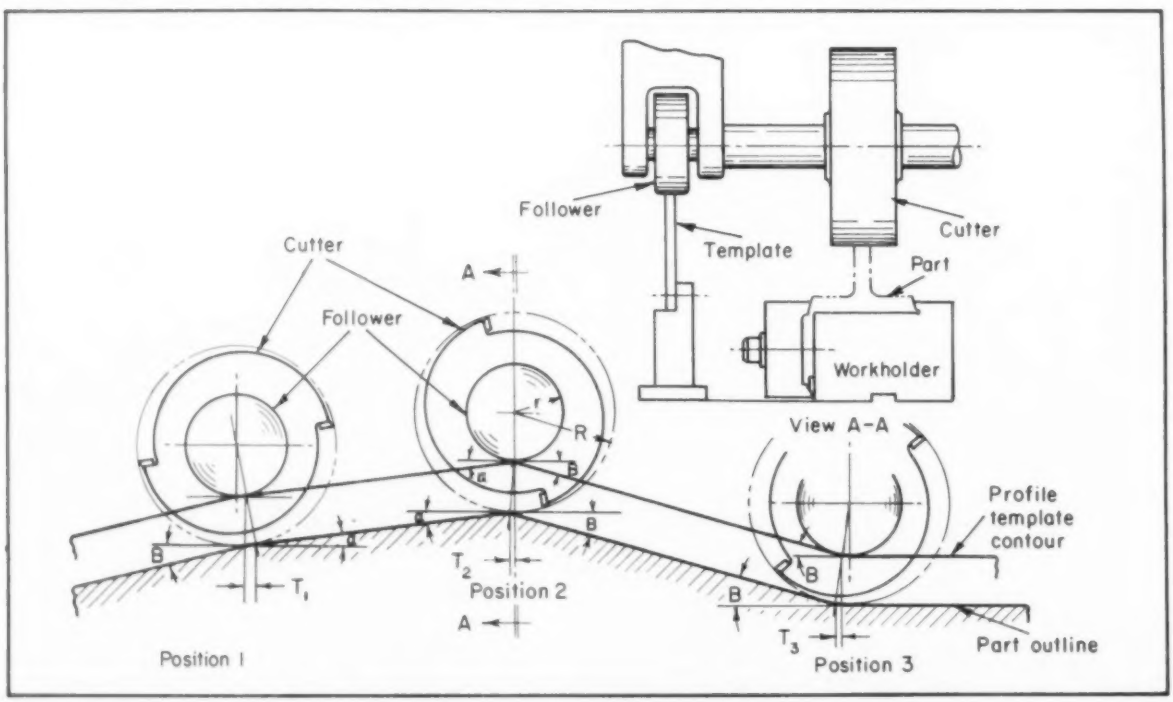
To begin with a basic case, the Onsrud spar milling machine takes a somewhat conventional milling arbor that will hold an eight-inch or larger diameter cutter with inserted carbide teeth. One end of the arbor carries an eight-inch diameter follower that controls the vertical direction of the cutter. The spar blank is held in a workholder such as described in a previous article, Spar Mill Tooling, THE TOOL ENGINEER, July, 1953. The profile templet that guides the cutter is mounted on brackets alongside the workholder. This is shown in *Fig.* 1, View *AA*.

If the cutter is also eight inches in diameter the profile templet is an exact duplicate of the part contour, but if the cutter is larger or smaller in diameter than the follower, it is necessary to offset the points of inflection on the templet to correctly reproduce them on the spar.

This difference between cutter and follower diameters is illustrated in *Fig.* 1, where the cutter is larger.

*Senior member ASTE Los Angeles chapter.

**Fig. 1. Diagram showing lead or lag when cutter and follower are of different diameters.**



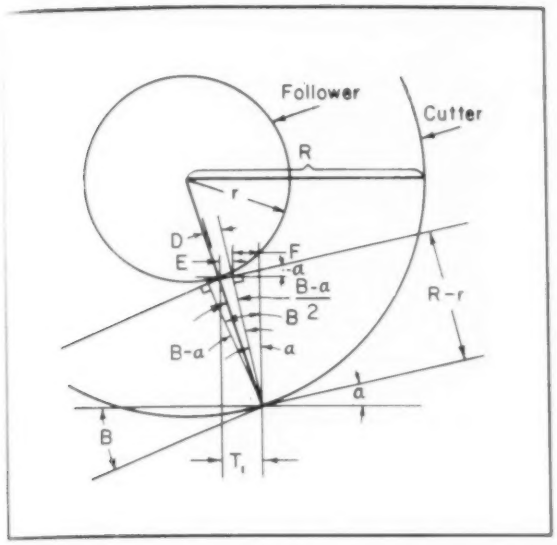



**Fig. 2. Detail of Position 1, Fig. 1, when cutter is ascending.**

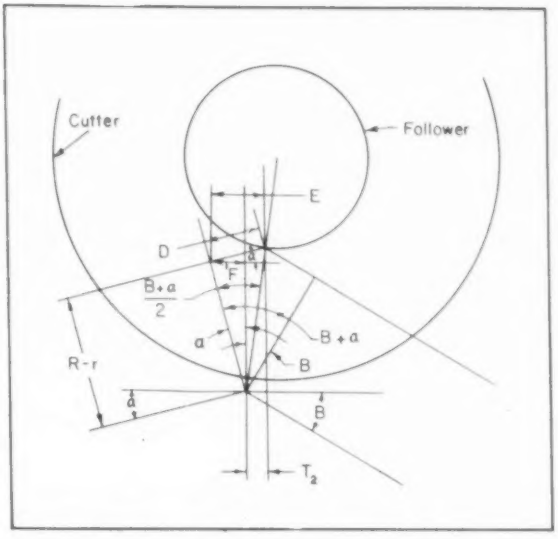



**Fig. 3. Detail of Position 2, Fig. 1, when cutter is at top of ascent and about to descend.**

At all positions the cutter is shown at the moment of change of direction. For Position 1, *Fig.* 1, shown in greater detail in *Fig.* 2, a value can be found which, when multiplied by the difference in radii between cutter and follower, is the horizontal offset $T_1$ between part and templet inflection points. The formula for the offset is derived as follows:

$$D = \tan\left(\frac{B-\alpha}{2}\right)(R-r)$$

and $$E = D\cos\alpha = \tan\left(\frac{B-\alpha}{2}\right)(R-r)\cos\alpha$$

$$F = \sin\alpha\,(R-r)$$

but $$T_1 = E + F$$

$$T_1 = \tan\frac{B-\alpha}{2}(R-r)\cos\alpha + \sin\alpha\,(R-r)$$

or $$T_1 = \left[\tan\left(\frac{B-\alpha}{2}\right)\cos\alpha + \sin\alpha\right](R-r)$$

At Position 2, *Figs.* 1, and 3 in detail, the offset between part and templet, $T_2$, is found by a formula developed as follows:

$$D = \tan\left(\frac{B+\alpha}{2}\right)(R-r)$$

and $$E = D\cos\alpha = \tan\left(\frac{B+\alpha}{2}(R-r\cos\alpha\right)$$

$$F = \sin\alpha\,(R-r)$$

$$T_2 = E - F$$

substituting

$$T_2 = \tan\left(\frac{B+\alpha}{2}\right)(R-r)\cos\alpha - \sin\alpha\,(R-r)$$

or $$T_2 = \left[\tan\left(\frac{B+\alpha}{2}\right)\cos\alpha - \sin\alpha\right](R-r)$$

**Fig. 4. Detail of Position 3, Fig. 1; cutter is at bottom of descent.**

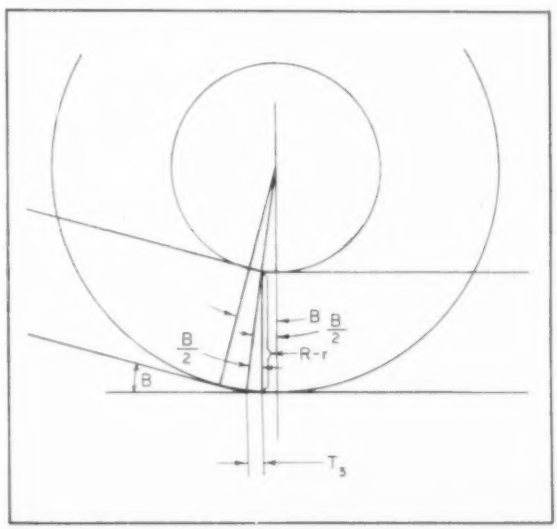
At Position 3, *Figs.* 1 and 4, the horizontal offset is simply:

$$T_3 = \tan\frac{B}{2}(R-r)$$

The resulting templet contour can be checked by solving for each of the slopes of the templet which must equal the corresponding slopes of the part.

With the Farnham spar milling machine, the cutter not only moves up and down, as controlled by a templet, but moves in and out. This enables the cutting of a taper in two planes as shown in *Fig.* 5.

As the cutter produces taper alpha, material is actually being removed by the back edge of the cutter as shown in section *BB*, *Fig.* 6. This type of cut produces a dished out effect as illustrated by the markings of the part shown in *Fig.* 5. If the angle



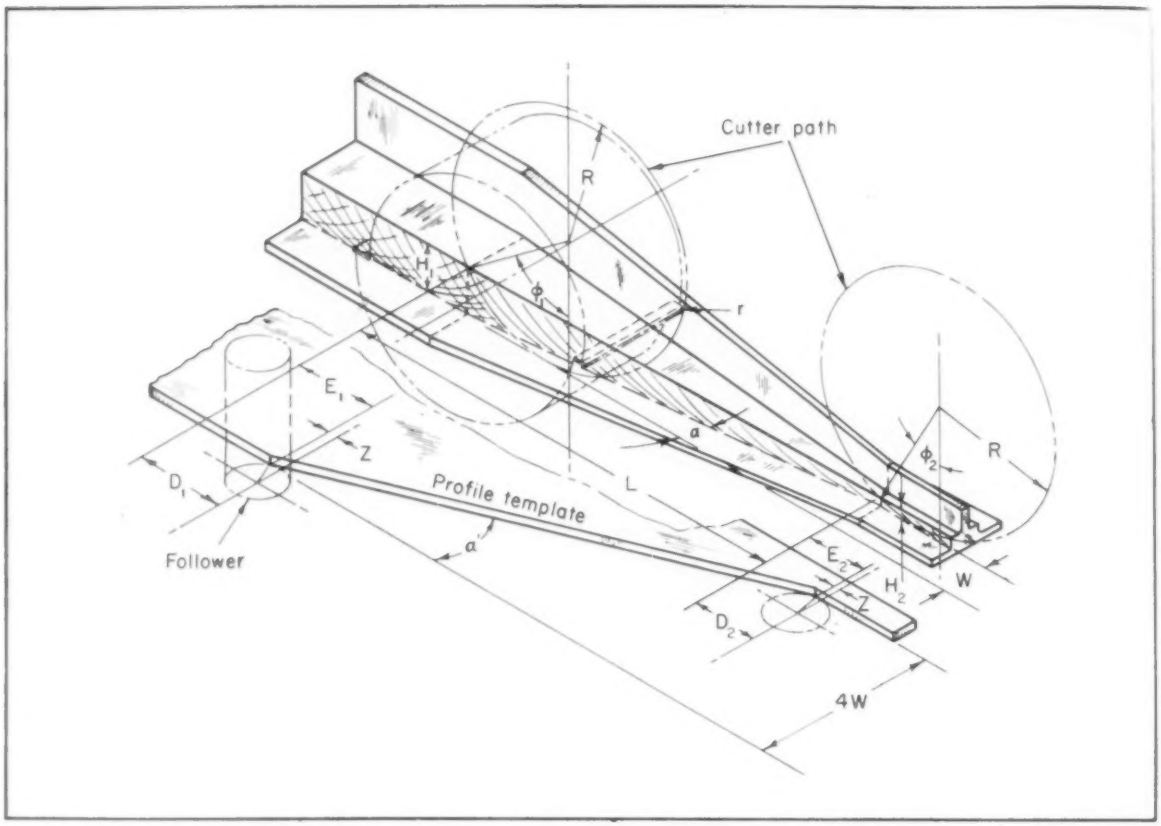



Fig. 5. Diagram of cutter and follower producing a horizontal taper.

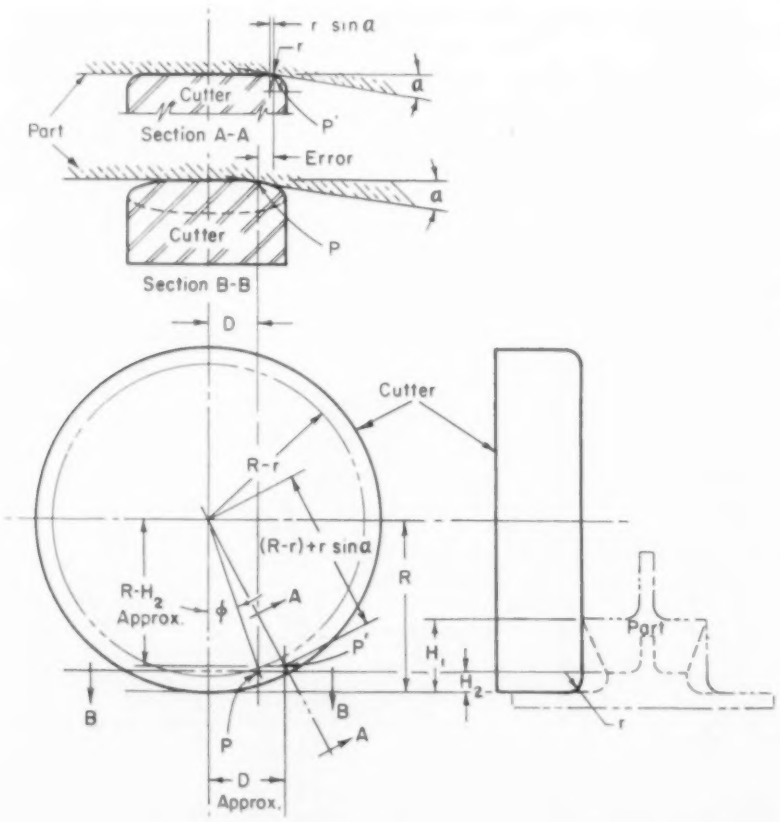



Fig. 6. Diagram illustrating error resulting from approximating tangent point of cutter and part (P).

f taper were very great the dished effect would be uite pronounced and sandblasting or sanding would ail to satisfactorily remove the marks. When this ut is confined to small angles of taper, the resulting nish is acceptable.

Since all spears have fillet radii varying from $\frac{1}{8}$ to $\frac{1}{4}$ inch or more, the actual point of cutter contact with the part is at a point tangent to the cutter corner radius as shown at *P* in *Fig.* 6. To locate the point of contact, *P*, it is necessary to calculate the tangent to a torus in plane *BB*. For all practical purposes in order to simplify figuring, when the depth of cut *H* approaches the cutter radius, the section through a torus is considered to be a section through a circle, that is, planes *AA* and *BB* are nearly coincident. Then the distance *D* is approximated as follows:

$$D^2 = [(R - r) + r \sin\alpha]^2 - (R - H_2)^2$$

$$\text{then: } D = \sqrt{[(R - r) + r \sin\alpha]^2 - (R - H_2)^2}$$

However, as the depth of cut *H* decreases to the dimension of the cutter edge radius and less, the error between approximating the torus section with a circular section rapidly increases and the designer must consider if the part print tolerance is sufficient to neglect this error. This error is illustrated, *Fig.* 6, and it is obvious that when the depth of cut *H* becomes small the error can amount to an inch or more.

It has been common practice among designers to neglect this error, then at tool trial the profile templet is reworked either by filing or inserting a section and so experimentally adjusting the templet until the cutter correctly cuts the part. This becomes costly if many templets are involved and results in considerable down time for spar mills. To avoid this expense, errors must be eliminated wherever possible before tool trial.

Because of the desire to eliminate rework of templets, the following procedure has been devised to permit rapid location of the profile templet inflection point to any desired degree of accuracy.

The offset *D*, *Fig.* 6, between point of cutter contact with the part and the corresponding inflection point of the templet will only be the same at each end of the cut if there is no change in the depth of cut, that is dimensions $H_1$ and $H_2$ are equal. To find *D* it is necessary to find angle phi utilizing a formula for a tangent to a torus, *Fig.* 7.

Given, equation of torus:

$$\left(\sqrt{x^2 + y^2} - b\right)^2 + Z^2 = r^2$$

partial derivative is as follows:

$$\tan\alpha = \frac{d\,z}{d\,x} = \frac{x\quad(R_x - b)}{R_x\sqrt{r^2 - (R_x - b)^2}}$$

where $\sin\varphi = \dfrac{x}{R_x}$

and $\cos\varphi = \dfrac{R - H}{R_x}$

or $R_x = (R - H)\sec\varphi$

solving for X and substituting

$$\tan\alpha = \frac{\sin\varphi\quad(R_x - b)}{\sqrt{r^2 - (R_x - b)^2}}$$

since $b = (R - r)$

$$\tan\alpha = \frac{[(R - H)\sec\varphi - (R - r)]\sin\varphi}{\sqrt{r^2 - [(R - H)\sec\varphi - (R - r)]^2}}$$

Since it is impossible to directly solve for phi, as there are two unknowns, a graph, *Fig.* 8 is constructed for the particular cutter to be used in making the cut. The example shown is for a 7-inch diameter cutter with a $\frac{1}{2}$-inch corner radius.

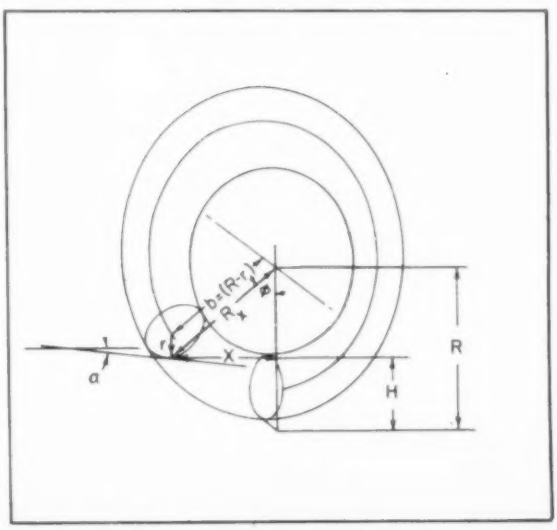
Following is the procedure for plotting the graph shown in *Fig.* 8: Lay out the graph using a scale of 1 inch equals 0.010 inch for *H* values unless the maximum and minimum *H* values that will occur are so extreme that a smaller scale is necessary, such as 1 inch equals 0.050 inch. The alpha angle can be plotted at a scale of 1 inch equals 20 minutes covering the maximum and minimum part angle.

Four points should be plotted for each phi angle. The initial value is found by solving for *H* in the formula:

$$H = R - (R - r)\cos\varphi$$

Suppose it is desired to plot the line where phi equals 7 degrees. Solving for *H* when alpha is zero in the derived formula for tan α *H* equals 0.522 inch. *H* is decreased by increments of 0.005 inch and

**Fig. 7. Diagram of torus and angle Phi.**



tan alpha is solved for in the formula to establish three more points, substitute values for $H$ of 0.517, 0.512, and 0.507 inch. Solving for tan alpha gives values of 0° 4′ 13″, 0° 8′ 24″ and 0° 12′ 40″ for alpha.

This must be done for each phi line on the graph in *Fig.* 8. While the process seems rather involved, the calculations are quickly performed and the graph is usable for all conditions involving this particular cutter.

If only necessary to find one or two points for a given cutter, rather than drawing a complete graph it is possible to make a full-size layout of the particular condition involved and scale the phi angle. Then a graph is made for that particular area, drawing lines for values of phi that are a few degrees either side of the scaled angle. For example, in laying out the condition where the depth of cut is 0.609 inch the phi angle is scaled and it is found to be about 15½ degrees. Therefore, rather than make a complete graph one could simply calculate the 15 and 16-degree lines and it would be seen that the 0.609-inch value is between them.

In this particular example the graph includes two extreme depths of cut, $H_1$ and $H_2$, on the part that goes from a depth of $H_1 = 0.609$ inch to $H_2 = 0.500$ inch. The graph is calculated from the tan alpha formula as explained above. Phi lines are drawn every degree and distances between are approximated. For example, a depth of cut of 0.500 inch and a horizontal part angle of 12 minutes would require a phi angle of approximately 5 degrees 55 minutes. For a depth of cut of 0.609 inch and the same alpha angle, phi angle would be 15 degrees 56 minutes.

The distance $E_1$, *Fig.* 5, may now be calculated from the formula which is derived as follows:

$$\tan \varphi_2 = \frac{D_2}{(R - H_2)}$$

$$D_2 = \tan \varphi_2 (R - H_2)$$

$$E_2 = D_2 - Z$$

$$Z = \tan \tfrac{1}{2} \alpha' r$$

Since

$$r = 1 \text{ inch (fixed radius of Farnham follower)}$$

then

$$Z = \tan \tfrac{1}{2} \alpha'$$

Substituting

$$E_2 = \tan \varphi_2 (R - H_2) - \tan \tfrac{1}{2} \alpha'$$

or

$$E_2 = \tan \varphi_2 (R - H_2) - Z$$

Similarly:

$$E_1 = \tan \varphi_1 (R - H_1) - Z$$

Phi taken from the graph, *Fig.* 8, is 5 degrees 55 minutes, and Z is equal to tan ½ $a^1$ for a 1-inch radius cam follower, which is standard.

It should be noted that this is one of the few cases where the follower does not travel the same angle the cutter takes. This is because a change of depth $H_1$ to $H_2$ causes a change of angle phi resulting in different values for $E_1$ and $E_2$.

Most Farnham spar milling machines are constructed with a four to one ratio between cutter and follower, that is, for a horizontal movement $W$ of one inch of the cutter, the follower moves four inches ($4W$). Therefore, the templet angle alpha prime used to calculate the $Z$ dimension is figured from the formula:

$$\tan \alpha' = \frac{4W}{L - D_1 + D_2}$$

where

$$D_1 = \tan \varphi_1 (R - H_1)$$

and

$$D_2 = \tan \varphi_2 (R - H_2)$$

While at first glance this may seem like an elaborate procedure it is the fastest method of accurately calculating profile templets. Once the graph is made, a series of templets can be accurately figured in an amazingly short length of time with the accuracy required to produce modern high-speed aircraft.

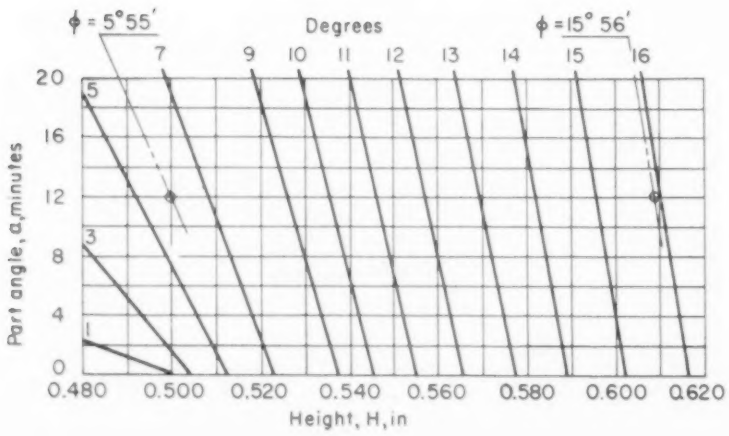



**Fig. 8. Chart for determining angle phi which is used in calculating offset between cutter and follower of a 7-inch diameter with 0.500-in. corner radius.**

# Magnesium Forming

## Part 3—In the Brake and Hydropress

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MAGNESIUM ALLOYS can be successfully formed by the brake and in the hydroform press if proper attention is given to minimum bend radii, forming temperature and time at temperature. The standard techniques used with other materials in the hydropress and the brake must be modified when working with magnesium.

### Brake Forming Magnesium

In comparison with aluminum alloys, QQ-M-44-0 magnesium alloy can be formed more severely in the brake at 550 F than 24S-0 can at room temperature. Hard rolled magnesium alloy, when it is formed at 325 F, exhibits slightly better formability than 24S-T3 does at room temperature, *Fig.* 1.

It is not always necessary to form magnesium alloy sheets at elevated temperature. Room temperature bending may be done to any radius that is greater than or equal to the room temperature bend radii. When possible, room temperature is recommended because of its economy. Smaller bend radii necessitate the use of elevated temperatures; 325 F for hard rolled and 550 F for annealed sheet. In general, bend radii reach absolute minimum design values of two thicknesses at 550 F, for annealed sheet, but current practice is to limit minimum bend radii to three thicknesses at this temperature.

**Types of Dies:** Design engineers usually specify the smallest attainable bend radius commensurate with material specifications. To match the specifications usually means working with maximum permissible strains in the heel of the bend. Since magnesium's tendency to gall is heightened by elevated temperatures, choice of die must be made after due consideration of friction forces and

**Fig. 1. Hard rolled magnesium can be hot formed easily in the brake. In this instance a stiffener is formed from 0.072-inch sheet in steam heated dies.**

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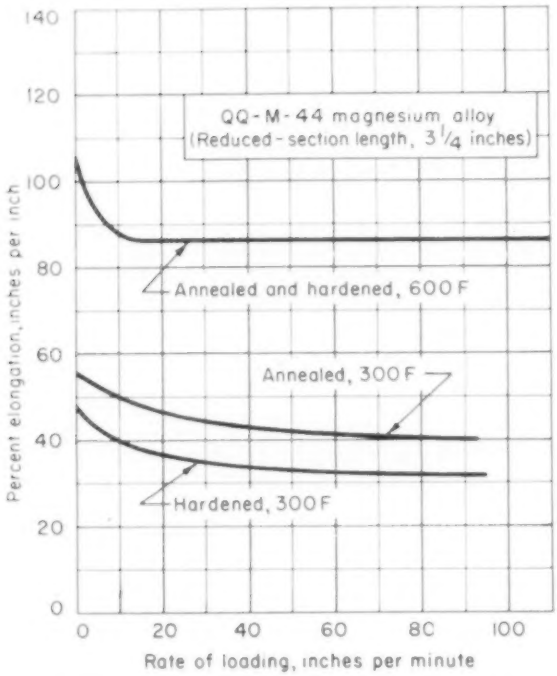



**Fig. 2. Magnesium is a material that should be formed slowly to achieve the best results, seen from these curves of the effect of tensile rate of loading.**

marking possibilities.

When material is bent by hatchet dies it moves in relation to the female die edges. An increase in the ever-present friction forces, produced by elevated temperature, causes increased tensile stresses around the nose of the punch. When these are added to the bending tensile forces, sufficient strain may be produced in the temperature-weakened material to cause failure. This would indicate use of rubber pad female dies but rubber cannot be used at elevated temperature. Metal dies must be used and these should have polished edges. For some forming operations, a lubricant may be required. Wide dies require less pressure for bending and cause less friction than narrow ones.

Any standard die can be used for brake forming magnesium alloys at room temperature. Their sizes are subject to limitations imposed by approach to critical necking strain limits. This is solely a function of punch radius when rubber block female dies are used, but is a more complicated function for channel dies, curling dies and others requiring a sliding action of the part over the die. These latter dies require lubrication at room temperature. Because of the relative absence of friction effect, rubber block dies and metal punches are recommended for room temperature forming of all gages up to 0.125 inch. Heavier gages require too much ram and rubber pressure to be practicable for this type of forming.

Female die widths and shapes required at any forming temperature are determined by the geometry of the dies and parts, and the tendency to compression marking. The latter is not the same as the coining action of two mating dies that have been caused to bottom.

When no criterion other than acceptable forming of a single flange of ample length is indicated, the usual rule of thumb applied to aluminum alloys is satisfactory for gages up to 0.125 inch. The die width is given by:

$$W = 2R_p + 2t + 0.10$$

where

$W$ = Die width, inches

$R_p$ = Punch radius, inches

$t$ = Metal thickness, inches

The minimum flange width is given for nonbottoming dies by:

$$F_{min} = \frac{W}{2 \cos \frac{\theta}{2}} - R_f \tan \frac{\theta}{2}$$

where

$F_{min}$ = Minimum flange width, inches

$\theta$ = Angle of bend, degrees

$R_f$ = Radius of female die edges, inches

**Speed of Operation:** Since magnesium is susceptible to the rate at which actual stretching or compression takes place, it is necessary to consider the actual forming speed in brake operations. Compared with stretch and hydraulic draw presses, a press brake is a high-speed machine. A typical brake operates at 36 strokes per minute and has

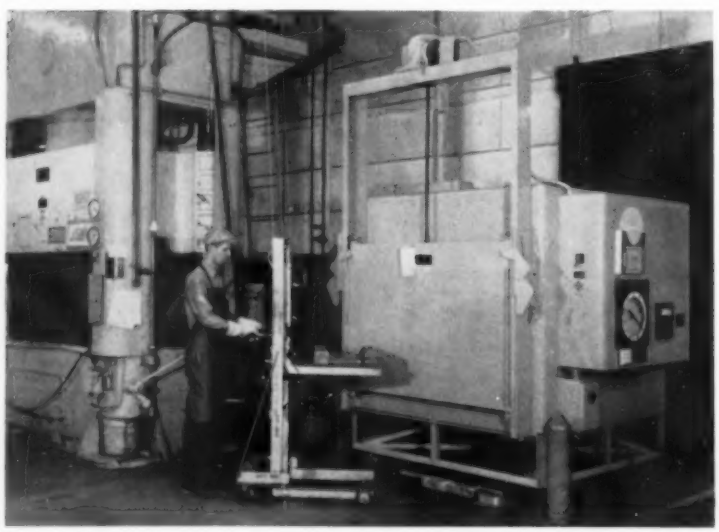


**Fig. 3. General arrangement of a hydropress and oven at Boeing. The Kirksite form block on the dolly transports it between the oven and the press.**

stroke of 3 inches. If a brake die 7 metal thicknesses wide is used with a punch having radii of metal thicknesses to form a 90-degree bend, about 21 degrees of crank travel are required to form 0.051-inch material. The time for one stroke cycle = 60/36 seconds. The time required for 24/360 of a stroke is thus 1/9 second.

This assumption includes the standard practice of interrupting the operation near the point at which the punch contacts the material. Differences observed in crank speed are small. Speed becomes maximum after a short acceleration period following such a stop.

Using the previous data, the total strain in the heel of the bend is:

$$\text{Average strain rate} = \frac{60ta}{2t}$$

where

$a$ = Angle, radians

T = Period to form, seconds

With 0.051-inch material this indicates an average rate of strain of 21 inches per minute. Instantaneous strain rates of at least double this value occur during bending. This would be true even if all the strain were uniformly distributed, but strain is never ideally distributed.

Rate of tensile loading curves, *Fig.* 2, shows that such a value is not low enough to be in the area of maximum elongation. Keeping in mind the type of alloy used, specific forming problems involving fracture or necking can be solved by changing either rate of loading or temperature.

The probability of acceptable forming at a specific temperature can be determined from the curves of rate of loading versus percent elongation for various temperatures. The average elongation in the heel of the bend is:

$$\varepsilon = \frac{t}{2R_p + t}$$

where

$\varepsilon$ = Elongation, inches per inch

$R_p$ = Punch radius, inches

$t$ = Material thickness, inches

If the percent stretch so calculated is doubled, and a rate of loading and temperature combination is taken from the curve to satisfy this value, the material can be formed without failure. The punch speed and die size can be estimated with sufficient accuracy from direct observation.

Elongation values for *Fig.* 2 were obtained from a tensile test that was plotted as a standard stress-strain curve. Since such curves are based on false premises, there is little correlation between test values and those achieved in brake forming. More work must be done to establish true stress—true strain curves that could be used with greater accuracy.

**Heating Methods:** Torch, oil bath, air oven and resistance heating have all been tried when forming magnesium sheet in a power brake. Torch heating is versatile and can be readily adapted to

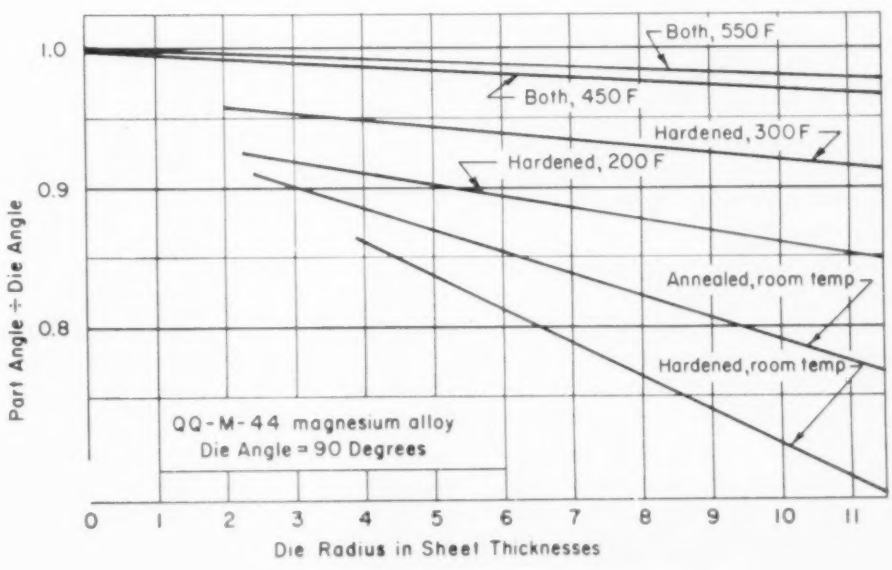



**Fig. 4. An example of the undesirable properties associated with cold hydroforming magnesium is the lack of control over angular springback at room temperature.**

various machines but the control of temperature is not exact. Hand pyrometers and temperature indicating crayons are used to indicate temperature, but the spot of maximum temperature may not be measured. The upper limit of temperature that may be specified for hand control must be lower than the standard maximum to insure a margin of safety. Optimum forming conditions are necessary when working near the minimum bend radius and torch heating is not recommended as a suitable heat source for either experimental or production brake forming. Although not recommended for heating parts, torches are useful when preheating dies.

Oil bath and air oven heating have two disadvantages in common. By either method, parts require heating of large areas and temperature losses from heating medium to point of operation are excessive. This becomes increasingly important as the metal gage is thinner, as parts become larger and as positioning becomes more difficult. The need for high-speed transfer from heating medium to forming position introduces a safety hazard.

Electrical resistance heating in the brake dies apparently avoids most of the difficulties associated with other heating methods. A typical installation comprises electric stepdown transformers, with a variable output up to 14 volts, plus electronic controls for heating to proper preset temperature. The electronic controls also interrupt the bending operation at the proper point. Electric current passes through the workpiece from the nose of the male die to the two edges of the female die.

Advantages of this system include automatic operation of the bending cycle, localization of heating, use of optimum temperatures and avoidance of hot part handling with its incident hazards. A change to resistance heating requires no new tooling because heat-treated steel brake dies perform just as well as copper alloy dies.

**Types of Failures:** Failures that have been experienced in brake forming magnesium alloy sheets have been those common to all metals, such as cracking and dimensional failures, plus some that are almost unique with this material. Elevated temperature forming produces failures in shear so the effect of notches is minimized.

Cracking of edges may be caused by biaxial stresses but this condition is not generally alleviated by any special dressing of edges. It has been shown theoretically and proved actually that changing the orientation of the direction of rolling makes no difference in results obtained. Remedies for edge cracking lie in raising the forming temperature or slowing the rate of loading.

One form of failure peculiar to magnesium sheet is the appearance of microscopic cracks some time after a forming operation is complete. Little is known of this type of failure, but it seems to be associated with oven heating and forming over cold dies. It is probable that microscopic failures occur at the time of bending but are not apparent until later. The remedy for this failure is formation at the proper temperature. With resistance heating, such failures should not occur.

A tendency to select excessively wide female dies sometimes results in die marking of adjacent bends or improperly contoured bends. The solution for such troubles lies in using minimum die widths commensurate with marking and radius requirements.

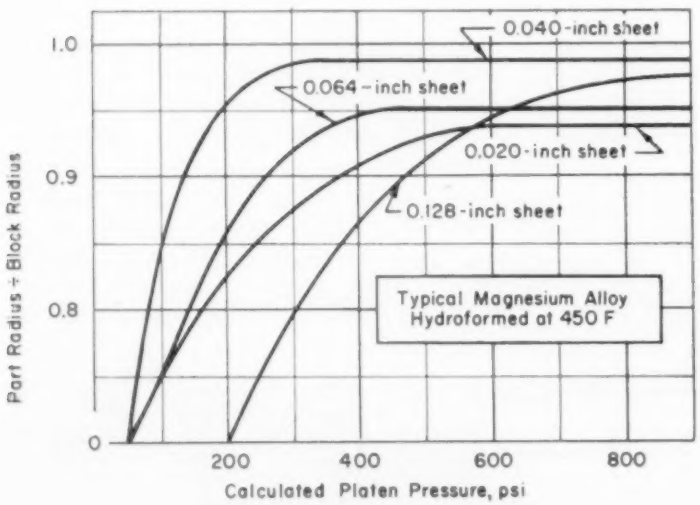



**Fig. 5. If the forming temperature is maintained constant and the rubber platen pressure increased, a point will be reached where greater pressure has no effect on springback.**

*—Per OSRD Report No. 6079*

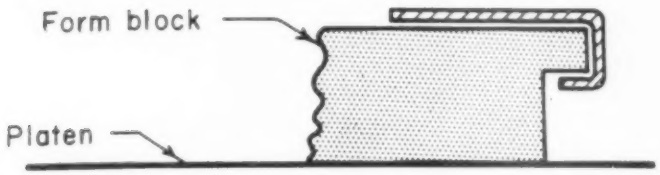



Fig. 6. Although hydroforming should generally be done with low pressure, parts having reentrant flanges, such as the section shown, cannot be formed with low pressure.

**Temperature Variation:** It is a common misconception that the minimum control temperature specified for the heating equipment must be followed in production. This is not necessarily true, and for bends formed on the brake, the governing variables are the compressive yield strength and the percent elongation in short gage lengths. Where actual instantaneous temperatures are measured, bends in material having a nominal forming temperature of 550 F can be successfully made at 400 F. A similar but lesser variation can be shown for material with a nominal forming temperature of 325 F. Many usable bends have been made at 270 F. This procedure is not recommended, but is mentioned to prevent unnecessary rejection of usable parts.

**Summary:** Limits for forming magnesium sheet in the brake can be summarized, on the safe side, as follows: Absolute minimum bend radii may be taken as one thickness for annealed sheet at 550 F, two thicknesses for hard rolled at 550 F and four thicknesses for hard rolled at 325 F, provided loading speeds are ten inches per minute or less and no part of the material or die in actual contact is less than the specified temperature. Resistance heating, steam or hot oil are acceptable heating methods. The widths of female dies may be reduced to six metal thicknesses for hot forming where die geometry will permit. This limit must be increased to nine metal thicknesses when gages of 0.125 inch or greater are to be bent. Rubber female dies are recommended for cold forming.

If necessary to secure lower rates of straining, wider female dies widths can be used, provided part geometry does not conflict. Rates of 20 inches per minute and up are considered satisfactory if design forming temperatures can be maintained. Other limits, such as flange widths, are not peculiar to magnesium alloys but are functions of brake, die and part geometry. To prevent long hot formed parts from distorting during cooling, it is recommended that they be cooled at a uniform rate. Best results are attained if parts are not cooled on metal tables.

## Hydropress Forming Magnesium

Experimental developments in hot forming magnesium alloy sheet by the hydropress method have resulted in establishment of definite limitations at elevated temperatures. Degree of deformation and springback characteristics are included in these limits. Under selected conditions, magnesium alloys can be formed on the hydropress to at least the same limits at 24S-O aluminum. Greater stretch, compression and bead depths can be obtained if forming conditions for the annealed magnesium sheet are used.

**Room Temperature Forming:** Magnesium alloys can be formed hot or cold depending on the characteristics of the part. In general, values allowed by cold forming are highly undesirable, but since the simpler hot forming method may not always be most economical, room temperature hydropress work must be considered. Angular springback for small radii, *Fig.* 4, serves as an example of the severe limitations on room temperature forming.

Hydropress blocks of hardwood, Masonite, hard plastic, hard plaster or metals can be used for room temperature forming. Block radii should be smooth and at least eight metal thicknesses. At radii of this magnitude, springback values are unreliable as they are for any other stiff alloys. Roll hardened magnesium further aggravates this condition because temper is not uniform for even a single sheet. For forming cylindrical sections of large radius, uncomplicated by secondary or compound curvature, and when springback must be made additive to the block and experimentally corrected, cold forming is recommended as a less complicated and less expensive procedure. Plaster blocks are most useful in such cases.

Cold forming has a tendency to produce a larger percentage of rejects because of local necking, minute cracks, edge cracks from stress-raising nicks and nonuniform compression failures. Whenever doubt exists, elevated temperatures should be used.

**Elevated Temperature Forming:** Blocks for

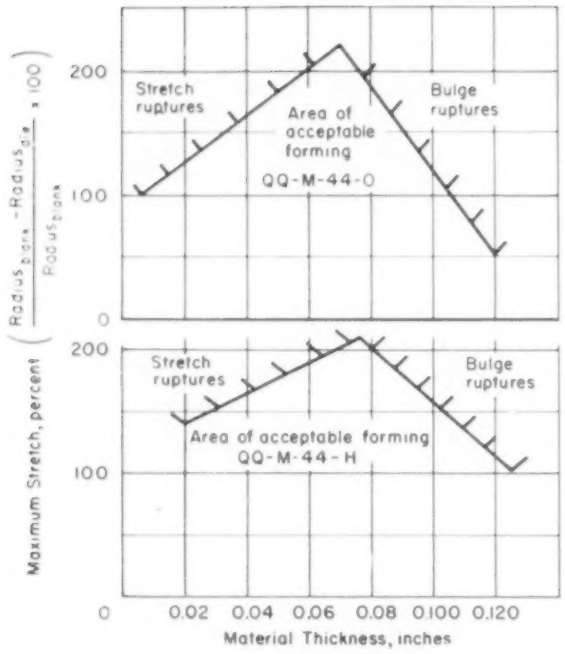



**Fig. 7. Variation of stretch flange limits for full circle, small radii parts formed at 300 F and optimum pressures.** —*Per OSRD Report No. 5791*

elevated temperature forming should be made of aluminum, Kirksite or magnesium. When these metals are used, no corrections for differential expansion need be applied when the parts are formed at the tool temperature. If tool and part are at different temperatures, a correction must be applied as outlined in Part 2 of this series. Because of the elevated temperatures a high temperature rubber blanket must be used to prevent undue damage to the rubber press pads, and an oven must be provided to preheat the block as well as the blank. This last is particularly important whenever tool pins are used for indexing. In cases where blocks are massive, the blanks can be heated from the block by conduction.

Before forming magnesium at elevated temperatures both the die and the rubber protector blanket must be heated. Formulations for these blankets have little plasticity at room temperature and even though the surface may be hot, if the center of the blanket is not also hot, the blanket is subject to early cracking or tearing. Its temperature should be allowed to rise to about 200 F in 15 minutes. This temperature should be regarded as an absolute working minimum.

**Method of Heating:** Metal hydroblocks may be heated by controlled temperature ovens, electrically or steam heated platens, or by hand if necessary. When nonindicating controls or hand heating are used, the temperature must be checked before actual forming is started. For production purposes, it is best to preheat dies rather than wait for them to come to temperature in the machine. Temperatures considerably higher than design limits can be used for preheating dies but only when automatic platen temperature control is also used.

Preheating of parts can be accomplished in air ovens or sandwich type platen heaters. The latter can be used on flat sheets only, but because heat is transferred by conduction proper temperature can be reached in less time than in ovens. One minute is often sufficient to heat a flat blank in a sandwich heater. Either type of heater should be limit controlled.

If stock must be heated to near limit temperatures, as with hardened magnesium, the operator should be made to realize that the limit is almost unattainable. Production time will be saved if heating is stopped about 25 degrees below the limit. Fit to the tool pins, slight increase in springback and the slight reduction in flange compression caused by this lower temperature will all fall within production tolerances.

Magnesium can be hydroformed at temperatures of 325 or 550 F, but results at the higher temperatures, effect on the equipment and more disagreeable working conditions do not warrant its use. Compression and springback control are only slightly better at the higher temperature.

Some parts, such as those having joggled convex flanges, may require the limit in compression, and for these forming temperatures above 325 F should be used. Experience has shown that the limit of nonrelief compression using available tools at 550 F for annealed sheet is slightly above 5 percent for 0.040-inch or heavier material and 900 psi operation. This is an increase of about one percent over 325 F results. Stretch flanges are ideally formed at the lower temperature limit, regardless of material temper. This is a result of the best combination of ultimate tensile strength and elongation.

**Rate of Loading:** The hydropress is by nature a slow speed machine. No difficulty need be expected and none has been experienced as a result of rate of loading.

**Lubrication:** Magnesium's tendency to gall increases rapidly as the forming temperature is raised, which is another reason for forming at 325 F. Many lubricants are available for preventing galling at 325 F, but most of these are unsatisfactory at 550 F either because of their high rate of distillation or their difficulty of removal after forming.

Petroleum lubricants should be avoided because of their effects on rubber. Even neoprene blankets are compounded with natural rubber and synthetics that are not resistant to petroleum lubricants.

Rubber treated with oil will rub off on the formed parts and is hard to remove. Because of the difficulty of cleaning the formed part, graphite, graphite emulsions and powders in general should be avoided. Vegetable-lecithin fat base compounds are the most successful because of the ease with which they can be removed from the formed parts rather than because of high lubricity.

All foreign material should be removed from formed parts as soon as possible after the forming operation. Oils and residues combined with moisture are primarily responsible for the corrosion often found on formed parts. Formed parts should be alkaline cleaned, and either regreased or dichromate treated.

**Platen Pressure:** Experimental work has led to conclusions on the optimum pressures for forming parts in the hydropress. Results of some of the experimental work are shown in *Fig.* 5. For a forming temperature of 450 F the lower critical rubber pressure for constant springback is about 800 psi for 0.125-inch sheet and less for lighter gages.

Customary low-pressure heads should be used on all hot hydropressing operations with magnesium alloys 0.125 inch or less. Magnesium sheet 0.125-inch thick may or may not be suitable for low-pressure head forming, depending on angles to be bent, incidence of flanges to platen, etc. Blocks having reentrant flanges, such as shown in *Fig.* 6 could not be used with low pressures.

Localized pressure requirements can be met by pressure plates as are required when forming joggles. Wiping blocks or set blocks should be avoided unless there is no sliding movement of the part relative to the form block. If there is sliding, lubricants should be used to prevent galling.

Failures of a highly variable nature have resulted from forming light gage parts with too high pressures (2300 psi). These failures include tearing of a part or a flange during the early stages of formation. The completed part may have a satisfactory flange adjacent to the one that suffered the rupture. The failures appear to be the result of tension. Since little is known of the mechanics of such failure, high pressure heads should be avoided whenever possible.

**Shrink and Stretch Flanges:** The principal use of the hydropress is in forming simple, curved flange patterns. Experiment has shown that the permissible increase in length exhibited by a concave or stretch flange far exceeds the useful reduction obtainable on a convex flange. It has also been shown that these properties bear little relation to stress-strain curve relations obtained from ordinary tensile test coupons.

Tests have shown that stretch flanges can be formed satisfactorily at about 325 F, and that values of percent stretch without rupture may run to 25 percent or more on flange segments. This is not a true indication of performance since for low pressures and high percent stretch; this cupping becomes worse as sweep radius is increased. The phenomenon is related to both springback, and the effective application and distribution of pressure. Conclusions of an analysis of this phenomenon, using radii from 1.5 to 4 inches and full circle stretch flanging are shown in *Fig.* 7. It can be seen that the values for acceptable forming are extraordinarily high.

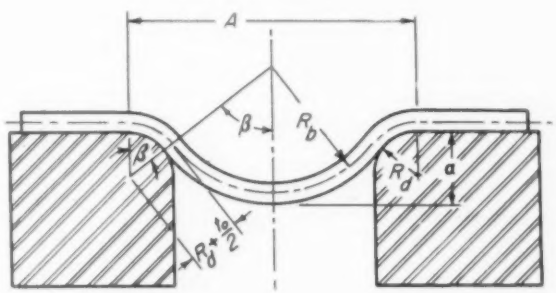



**Fig. 8. A measure of beading is given by the maximum percent stretch, which is determined by the ratio of the bead width (*A*) to the bead height (*a*).**

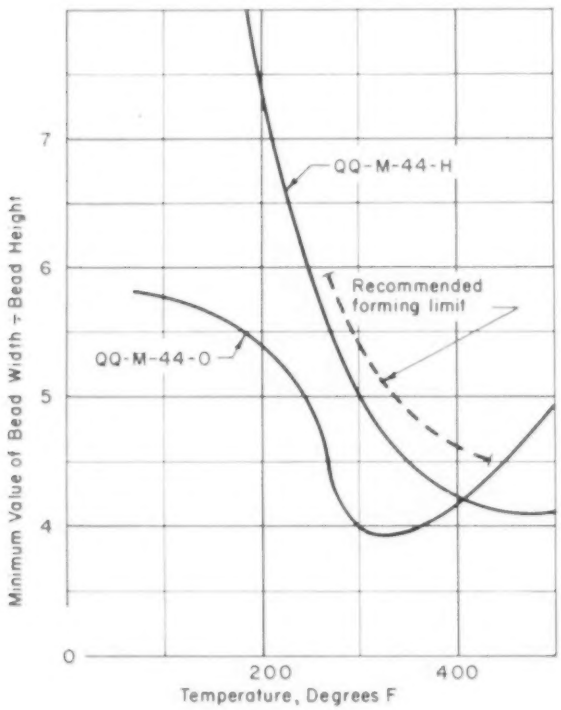
It has been concluded that flange height limits of stretch flanges far exceed those required for aircraft construction. However, additional work is being done to determine maximum stretch that can be accomplished without "canning," cupping and rupture.

The limiting values of shrink flanges are more nearly apparent from tests. The upper limit is about 5 percent for 900-psi operation on gages of 0.040 inch and heavier. If reliefs are added, their calculation is not so simple. Notch reliefs offer no problem, but finger or dimple reliefs are complicated by the problem of their distribution. This is particularly true when joggles are partly respon-

sible for excessive shrink requirements.

In general, the calculated shrink obtained from a combination of reliefs will be somewhat short of that necessary. Where possible, 20 percent additional shrinkage by relief should be provided to account for distribution and the small amount of stretching done in forming the dimple. Since the angles of bend at the entrance to the reliefs become small by this method, the radii at the edges of the reliefs are inconsequential.

**Fig. 9. Calculated ratios of (*A*/*a*) min. for maximum uniform strain at various forming temperatures are based on data for internal beading.** —Per OSRD Report No. 5042




**Beads:** Beads are formed with little difficulty on magnesium sheet. Present technique calls for stretch-forming temperatures of about 325 F because beading is almost wholly a stretching operation. Because almost perfect restraint occurs on all sides of the bead, no difficulty is experienced because of magnesium's inherent tendency to wrinkle. Beads of both internal and external types are quite possible, with externals being slightly easier to produce.

The maximum permissible strain approaches the limits given by a tensile test of comparable gage length when internal beads are used. If uniform strain is calculated from geometry of the bead, a value of maximum percent stretch from a standard tensile test serves as a useful criterion. This is possible because both measure similar quantities. No external friction is present on the test specimen and minimum friction effect is given by the rubber to the bead material in forming that portion of the bead beyond the edge radius.

A measure of beading is given by the maximum stretch that is determined by the ratio *A*/*a*. *Fig.* 8. In that illustration:

$R_b$ = Bead radius

$R_d$ = Die radius

$t_o$ = Original sheet thickness

$a$ = Bead height

$A$ = Bead width

A set of empirical curves has been developed that directly relate *A*/*a* values to maximum obtainable strains at fracture, and thus give suitable limits. These curves, *Fig.* 9, show that the absolute limit of *A*/*a* is attained at a temperature of about 325 F and equals slightly less than 4. Since these values are based on data from internal beading only, it is safe to assume that external beads can be formed to these dimensions and better because of the combined stretching and compression effect. For multiple beading, proximities at least equal to those for annealed 24S aluminum alloys can be used. This is true because of magnesium's greater drawability and lower minimum *A*/*a* value. Edge distances also compare similarly. Since these values are already at a minimum practical value for aluminum alloys, their continued application to magnesium is recommended.

**Summary:** The following limits are suggested for hydropress forming of magnesium: Limit room temperature forming to relatively large uniaxial contours. Do general hot forming at 325 F but for maximum compression form at the limit temperature of 550 F. The usable limit for stretch flanges is 25 percent, with much more for full circle flanging. Maximum compression without reliefs is limited to 5 percent if gages of 0.040 inch or heavier are used; 3 percent is a safe limit for 0.025-inch sheets. The minimum ratio of bead width to height is 4. Minimum bead margin is 0.38 inch and beads should be separated by at least 0.76 inch.

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FLEXIBILITY down to minus 120 F is the outstanding quality of a low-temperature silicone rubber compound which has just been developed by the Chemical Div. of General Electric Co. This low temperature pliancy, researchers explain, has been achieved with little loss of other desirable properties such as resistance to heat and insulating ability.

# drop forging

By Ralph H. Eshelman
Associate Editor

FROM THE PRODUCTION VIEWPOINT, the merits of forgings made in closed dies by drop hammer lie in the economies secured by simplifying manufacturing processes. Hot working of metal within closed dies produces nearly finished parts in one process, reducing the time and cost of manufacture. The dimensional accuracy achieved reduces metal waste and cuts finishing time to a minimum.

Paradoxically, drop forging is an integrated process requiring considerable supplementary equipment. For example, the basic equipment used in producing a relatively small part, such as a corn picker gear, consists of a heating furnace, drop hammer and trim press, *Fig.* 1. In addition to these, drop forgings also involve preliminary steps, including cut-off or shearing operation on the blank and smith-forging a tong hold. Finishing steps may involve press bending or straightening, coining, *Fig.* 2, upsetting, heat treating, sandblasting, *Fig.* 3, and grinding or belt sanding.

Of all the forging methods, it is estimated that at least 80 percent of the total tonnage is produced by drop hammers. Smith forging with open or flat face dies is confined largely to simple, symmetrical parts or extremely large pieces. Machine forging or upsetting is limited mainly to heading bolts, rivets, or other long, thin parts. In recent years, press forging has been coming into greater prominence, especially for large nonferrous parts.

## Process and Equipment

Three main types of drop hammers are in common use, namely: board hammer, *Fig.* 1, air-lift gravity-drop, *Fig.* 4, and steam piston, *Fig.* 5. The basic process is the same for all types. Forging dies, *Fig.* 6, in which impressions have been cut, are keyed into the movable ram in the stationary anvil cap. Ways in the columns and in the sides of the rams assure that each blow of the die strikes in the same place. Dies must be perfectly aligned or forgings produced, *Fig.* 7, will not be in match,

*Photo courtesy Interstate Drop Forge Co.*

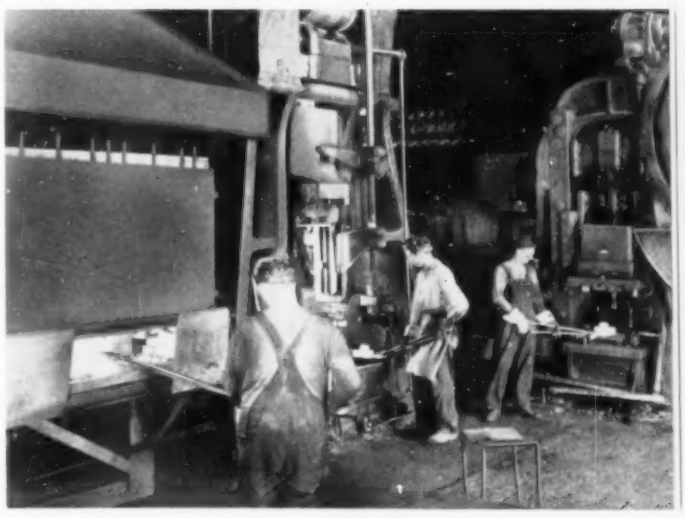


**Fig. 1. Typical equipment group for drop forge operation. The heater loads the furnace and delivers heated bars to the hammer. The hammer man performs the forging operation. The press man performs trimming, punching, straightening operations.**

**Fig. 2. Coining on mechanical press cold sizes thickness dimensions of forging to close tolerances. This frequently eliminates expensive machining.**
*Photo courtesy Drop Forge Assn.*

that is, the impressions in the upper and lower dies will produce an off-center forging.

Setting up dies and tools in the hammer and its auxiliary equipment may take from several hours to a day, depending on complexity of the forging to be made and size of the hammer used. Once dies are set up, they are preheated to prevent breaking under impact. Then a steel bar or billet, cut to the proper length, heated to forging temperature, 2100 F to 2400 F for steel, is placed over the first impression in the die. A number of strokes are required in each die impression. Ferrous material for forging is usually hot rolled stock in bar or billet form, cut to length. Alligator shears are generally used although guillotine shears, torch cutting or automatic saws may be employed. Saw cutting is preferred for bars or billets to be placed on end in the die for proper grain flow of round parts such as gears.

The board hammer is the oldest and most commonly used forging machine. The ram carrying the upper die block is fastened to boards which pass between rotating rolls. Pressure of the rolls against the boards raises the ram and upper die to a predetermined point for release. Force of the blow is contingent upon the combined weight of the falling ram and die and the height to which they were raised.

Another gravity hammer, the air-lift type, *Fig.* 4, is made in sizes ranging from 500 to 5000 pounds falling weight but larger sizes are being designed. Weight of forgings produced is approximately the same as for board hammers. In this type, the lifting force of the air-driven piston is transmitted to the ram by means of a rod connected to it. When the ram reaches its top position, it is held by a mechanical clamp until released. Air pressure is used only for lifting and is not applied in the downward stroke. Because of the nature of the hammer, there are definite die limitations which must be observed. Tool die heights for gravity hammers are shown in TABLE 1.

The steam-piston drop hammer, operated by either steam or compressed air, has a double acting cylinder on the ram. The force of the blow can be controlled by the operator from a light tap to the full force imparted by the steam-driven ram. Steam hammers are used for larger forgings, sizes up to five tons have been produced and for intricate designs that are difficult to forge. The striking force in this equipment is entirely under the control of the operator.

**Fig. 3. Sand blasting removes scale from surface of forgings.** *Photo courtesy Drop Forge Assn.*

## Supplementary Operations

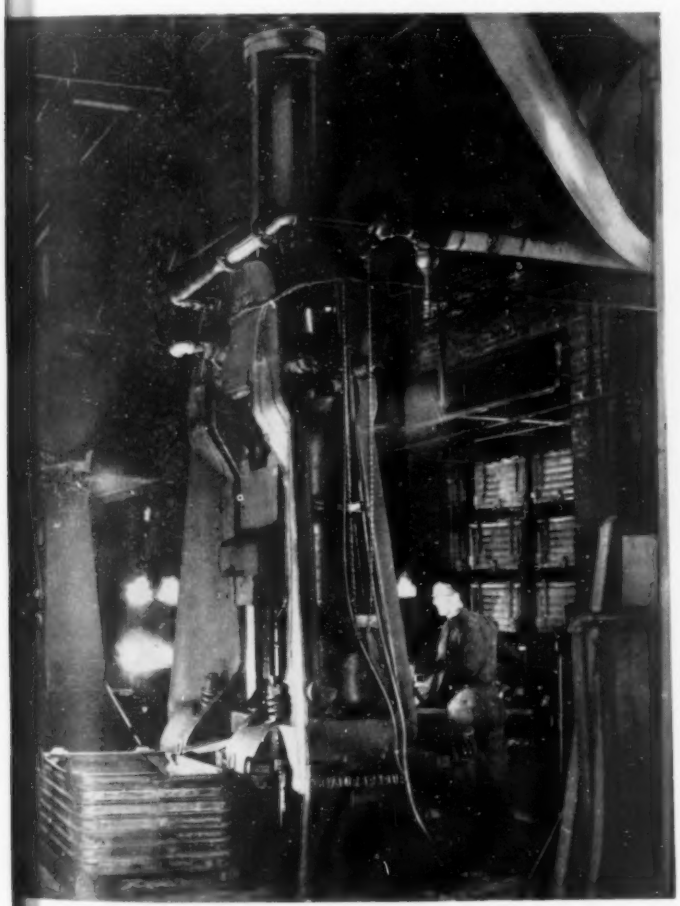
After the forging itself has been completed in the drop hammer, the part goes to a trimmer press where a set of dies, *Fig.* 8, trims the flash metal from the completed forging. This equipment is usually located near the hammers as shown in *Fig.* 1, so that the parts may be hot trimmed immediately after forging. Sometimes, however, the part is trimmed cold, particularly for small pieces forged two or more at a time from a single piece of stock. The part may also be cored in a punching operation along with the trimming. Later, forgings may be heat treated for various purposes: to secure more uniform grain structure, to relieve stresses, to increase machinability, to harden the surface and the like. Processes used include annealing, normalizing, surface hardening, induction hardening, flame hardening, cyaniding, nitriding, sulphurizing, and immersion heat treatment with oil, lead or salt baths.

Another operation frequently used to size the forging closer to finished requirements is coining, *Fig.* 2. This process is used as a high-production step, which reduces the need for later machining. Crank presses are often employed. With a heavy-duty press, it is possible to obtain tolerances on thickness dimensions within ± 0.005 and sometimes ± 0.002 inch. The dies used allow a flow of metal so that the pressure applied forces any excess on the surface being coined to move to adjacent surfaces. Dimensions which are to be coined must therefore be between those opposed surfaces. There must be adjacent surfaces also, to which excess metal may move. The process of coining often results in savings in finished parts by eliminating expensive machining operations.

Frequently, a grinding operation is used to remove burrs, which may have been left at the parting line when the forging was trimmed. Disk grinding is also performed on some forgings to obtain

**Fig. 4. Air-lift gravity drop hammer is a newer, more efficient design in which a rod and piston replace hardwood boards and rolls of conventional board hammer. Ram is free-falling.**

*Photo courtesy Chambersburg Engineering Co.*



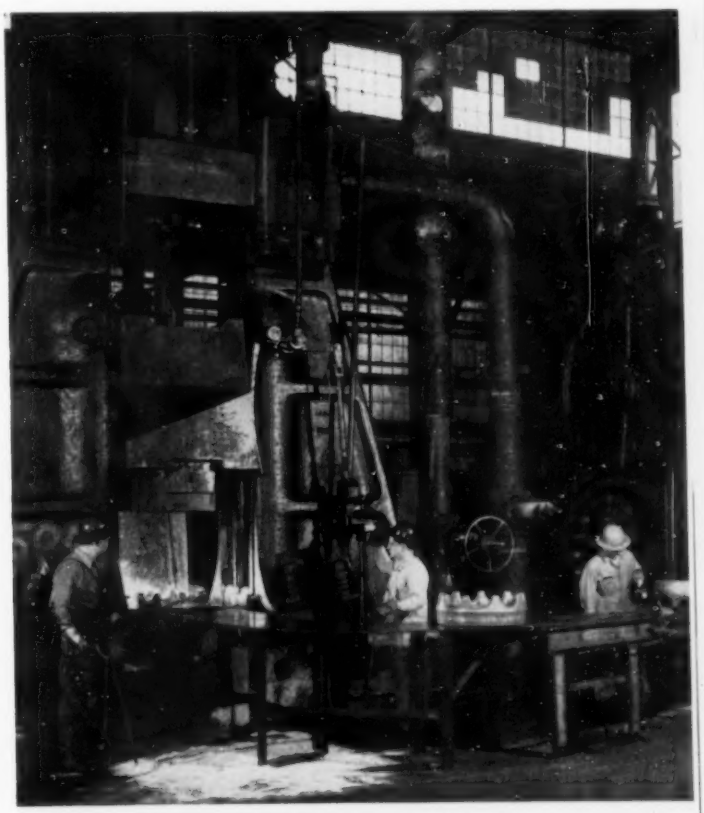


**Fig. 5. Steam piston hammer, used for larger forgings, operates as steam engine with hammer blow accelerated by steam pressure. More complete control of blow can be obtained both in length of stroke and force exerted, compared with gravity type hammers.**

*Photo courtesy Aluminum Co. of America*

closer tolerances, and smoother surfaces. Frequently, forgings require no other finishing.

Removal of ferrous oxide scale formed during forging and heat treat operations can be accomplished in several ways, each of which has certain advantages. Sand blasting is preferred by many and gives the best finished surface. Tumbling is often used for small parts, provided there are no thin sections likely to bend. Pickling in sulphuric acid solution also gives good results.

Other auxiliary equipment used to help produce a drop forging may include the single or double frame smith hammer. Tong holds are formed on prepared stock on its flat dies for such parts as crankshafts. Forging rolls are used to reduce short, thick sections to long, slender sections for the later drop-forge operation. The helve hammer is used for light, high-speed work of fullering, drawing, planishing, and flattening.

*Courtesy Aluminum Co. of America*

**Fig. 6. (left) Forging die for truck shackle with edging, blocking and finishing impression.**

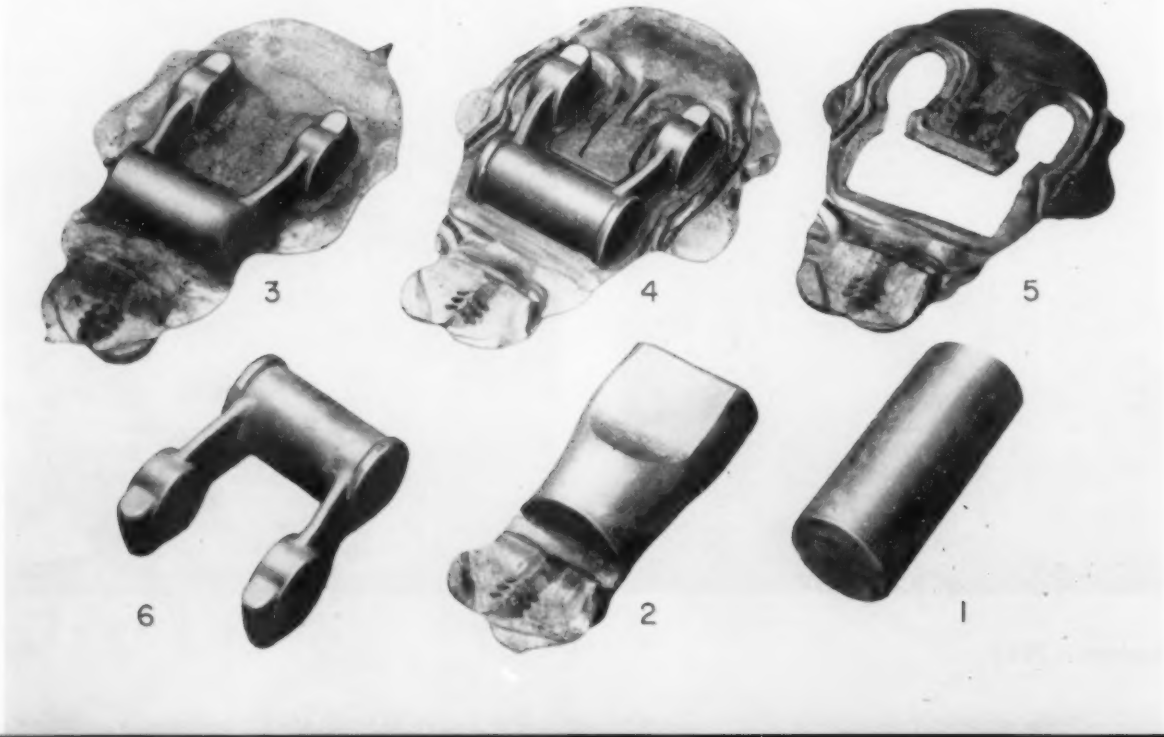
## Materials

In addition to using common steel alloys for forging, large volume production also utilizes other alloys such as stainless steel, brass, bronze, aluminum and magnesium. The National Association of Purchasing Agents has classified forging materials as follows:

1. Carbon Steels:
   (a) Low carbon up to 0.25 percent for moderate conditions and for carburized parts where abrasion resistance is needed.
   (b) Medium carbon (0.30 percent to 2.50 percent) for more severe service and where some heat treatment is desired.
   (c) High carbon (about 0.50 percent) for hard surfaces in springs and where heat treatment is essential.

**Fig. 7. (below) Forging formed in die in *Fig.* 6. Shown are: (1) stock, (2) stock broken in edging impression, (3) forging rough formed in blocking impression, (4) forging as it leaves finishing impression, (5) flash metal removed in trim press, (6) completed forging.**

*Photo courtesy Drop Forge Assn.*



2. Alloy Steels (manganese, nickel, chromium, molybdenum, nickel chromium, vanadium, chromium vanadium, tungsten, silicon manganese): These steels are used for higher strength, resistance durability and the like, proper selection depends upon the particular service requirements.
3. Stainless Steels: Where corrosion and heat resistance are required. Generally, forged surfaces should be polished to obtain benefit of properties.
4. Iron: Either wrought or ingot iron is used where ductility is required.
5. Copper, Brasses and Bronzes: Copper forgings have extensive applications in the electrical field. Brass and bronze alloys are used for moderate corrosion applications. Some bronzes also have moderately high strength and good bearing properties.
6. Nickel and Nickel-Copper Alloys: Alloys of nickel and copper (monel metal) offer desirable combination of strength, toughness and corrosion resistance.
7. Light Alloys (aluminum and magnesium): Having about one-third the weight of steel, these alloys have approximately the same strength as low-carbon steel.

**Table 1—Maximum & Minimum Die Heights for Gravity Drop Hammers**

| Size Drop Hammer | Closed Die Height C in Inches | |
|---|---|---|
| (lb.) | Maximum | Minimum |
| 500 | 8½ | 4 |
| 750 | 10½ | 5 |
| 1000 | 12 | 6 |
| 1500 | 15 | 8 |
| 2000 | 16 | 9 |
| 2500 | 16 | 9 |
| 3000 | 17 | 10 |
| 4000 | 18 | 11 |
| 5000 | 19 | 12 |
| 6000 | 21 | 13 |
| 8000 | 22 | 14 |
| 10000 | 23 | 15 |

*Data courtesy Chambersburg Engineering Co.*

## Applications

Advantages of drop forgings stem from the high strength-weight ratio of parts produced and the possibility of lower unit cost for large production runs. Forged parts frequently offer ideal solutions to problems involving high-speed rotating or oscillating machine elements. They endure shock and repeated applications of stresses to an unusual degree. For this reason steel forgings are used for such parts as shifter levers, crankshafts, torque rods, coupling parts, chain hooks, connecting rods, etc., *Fig.* 9. Aluminum forgings are used in even greater variety to take advantage of lightweight and corrosion resistance. Applications range from aircraft engine cylinders to hardware and fittings.

The process is advantageous to the production engineer because high-volume operations may be utilized and relatively little machining or other finishing is required. In addition most forgings can be made of materials of excellent machinability which provide fine machined finishes. The soundness and uniformity of metal structure of forged parts also simplifies inspection and reduces scrap of finished parts.

An extension of the drop forging method makes

**Fig. 9. Typical steel drop forgings in various sizes from 5-oz adjusting wheel to 883-lb landing gear cylinder.** *Photo courtesy Drop Forge Assn.*

*Photo courtesy Aluminum Co. of America*

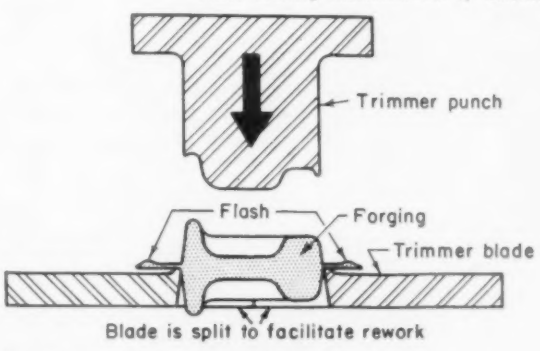



**Fig. 8. Sectional view of trim die set.**

use of weldments to take advantage of desired characteristics of forged parts, combining them with other forgings, castings, stampings, etc. In this way a part too complex to be forged as a complete unit is broken down into relatively simple components that can be forged and welded together on a production basis. An application of this principle occurred in engineering the manufacturing processes for an automatic transmission for trucks and buses. The design called for an aluminum forging for the torus and vanes but was impossible to forge as a unit. To solve the problem vanes and torus were forged separately. The parts were then assembled by furnace brazing.

In another instance severe service conditions dictated that forgings be used for long gear racks for large power shovels. The original design was too long for forging, so the teeth were forged in short lengths and welded to a cast base. By making the teeth in a standard size, gear racks for all models were economically produced by linking together desired lengths.

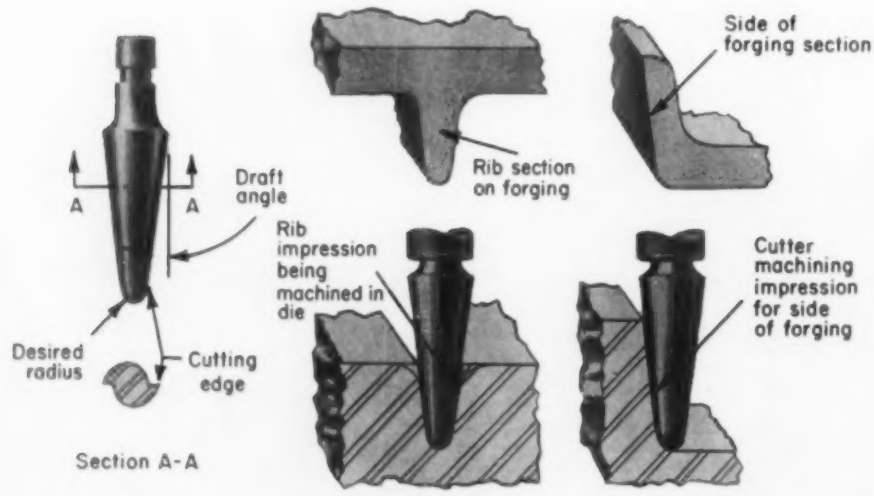
A consideration of particular importance is that nonferrous metals being less ductile than steel at forging temperatures require larger forging equipment for parts of the same volume. Also heat treatment is more critical for nonferrous forgings, ranging from 680 to 860 F. A variation of only 100 degrees on the high side might completely ruin the stock. Because of characteristics of these metals at forging temperature, laps or cold shuts occurring during the process will remain in that condition. Careful die design is required and preliminary blocking dies must have shorter ribs and bosses and larger fillets in order to provide easy flow of metal.

**Table 2—Draft Dimensions for Standard Draft Angles**

| Depth in Inches | Taper in Inches on One Surface | | |
|---|---|---|---|
| | 1° Draft | 5° Draft | 7° Draft |
| 1/32 | 0.0005 | 0.0027 | 0.0038 |
| 1/16 | 0.0011 | 0.0055 | 0.0077 |
| 3/32 | 0.0016 | 0.008 | 0.0115 |
| 1/8 | 0.0022 | 0.011 | 0.015 |
| 3/16 | 0.0033 | 0.016 | 0.023 |
| 1/4 | 0.0044 | 0.022 | 0.031 |
| 5/16 | 0.0055 | 0.027 | 0.038 |
| 3/8 | 0.0065 | 0.033 | 0.046 |
| 7/16 | 0.0076 | 0.038 | 0.054 |
| 1/2 | 0.0087 | 0.044 | 0.061 |
| 5/8 | 0.011 | 0.055 | 0.077 |
| 3/4 | 0.013 | 0.066 | 0.092 |
| 7/8 | 0.015 | 0.077 | 0.107 |
| 1 | 0.017 | 0.087 | 0.123 |

*Data courtesy Aluminum Co. of America.*

Certain magnesium alloys and some high-strength aluminum alloys, such as 75 S, do not work well under impact. Therefore, it is difficult to produce forgings from these metals in hammers, though it can be done when extreme care is employed. As a result, most of these are produced in presses, especially the larger sizes. In general, nonferrous forgings produced on the drop hammer are less than 100 lb in weight.




Typical die sinking cutter

**Fig. 10. Die sinking is simplified and costs reduced by using uniform draft angles.**

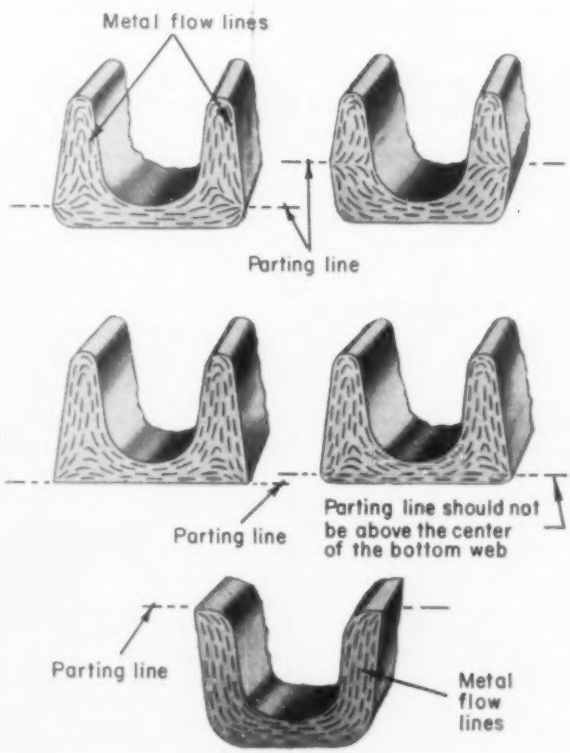
*Photo Courtesy Aluminum Co. of America*

### Cost

While drop forgings are being produced in small quantities of a few pieces, there are definite cost limitations within which it is uneconomical to produce forgings. In both drop and press forging, the cost of closed impression dies is an important economic consideration. This item may run from $1,000 to $2,000 for a drop hammer die for a small automotive part weighing about one pound, up to $20,000 for a complex aircraft die.

Time required for templet layout, pattern making, die-sinking, tryout and approval may also be a factor on a single-run small lot. In some parts, such as aircraft, even though a limited number is to be produced, forgings have a competitive advantage resulting from reduction of dead weight die. There are also savings from reduction in machining time over other methods, and from the lesser amount of material which must be removed by machining.

**Fig. 11. Die parting lines must direct flow for most strength. Top design is bad; flow makes unfilled sections and rupture at parting lines; center better left, cheapest, all impressions are in one die; bottom, good grain structure at ends of ribs.**


Metal flow lines
Parting line
Parting line
Parting line should not be above the center of the bottom web
Parting line
Metal flow lines

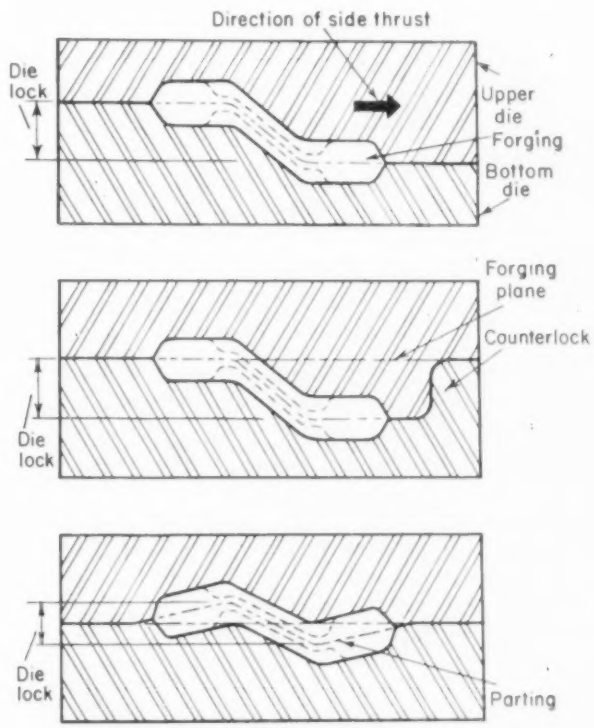
### Die Design

Correct tooling is important in securing high-quality forgings at economical cost; for example, as a general rule, a 7-degree draft is preferred on external surfaces and a 10-degree draft on internal surfaces of the part, such as sides of holes and pockets, for easy removal from the dies after forging. Considerable savings can be gained by designing forgings with constant draft angles, so that in the die-sinking operation, *Fig.* 10, a standard cutter with a 7-degree taper can be used. Standard draft angles and dimensions are given in TABLE 2.

The measurements of drafts are expresesd as angles from the axis of the hammer stroke with the stroke perpendicular to the forging plane. When the parting line is inclined with respect to the forging plane, or if principal dimensions of the forgings are laid out in another set of axes, draft is still referred to the stroke of the hammer.

Blending of two different planes for bearing draft is accomplished with frequent change of cutters but the process may involve a considerable amount of handwork on the die. Matching draft is specified when ribs or sidewalls, which meet on the

**Fig. 12. Lock dies, top, impractical as side thrust makes it impossible to hold dies in match; center, counterlocks should be avoided where possible; bottom, part inclined to forging plane is preferred.**
*Courtesy Aluminum Co. of America*



trimmed contour of the forging, extend to different depths on opposite sides of the parting line on the die.

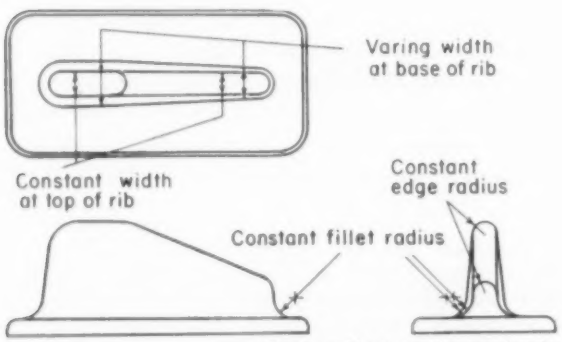
The parting line should be simplified as much as possible for quality and production considerations as well as die economies. Flat side forgings present an opportunity for reducing die costs since it is possible to use a flat top die with the entire impression machined in the bottom die block. Ordinarily this possibility is confined to aluminum and other nonferrous parts. Steel forgings are best designed with impressions in both die halves with most of the projection in the upper half. Scale then drops out of the upper impression and is blown away from the work. The slight impression in the lower half assist in locating the metal for forging. Shown in *Fig.* 11 are some examples of recommended practice in location of parting line in dies for a channel part to secure desirable metal flow lines. Usually the die is laid out so the parting line encircles the largest cross section of the piece since it is easier to spread metal than to force it into deep die depressions.

Ideal location of parting line is not always possible because of the shape of the part. Grain flow characteristics in forgings are affected by the location of the parting line as shown in *Fig.* 11. Also excess metal forged from the cavity into the gutter when the dies come together may form an undesirable pattern if its path is not smooth. If the parting line is on the outer side of a rib, it should be placed either adjacent to the web section or at the opposite end of the rib from adjoining web.

When parting lines must be in two or more different planes, counter locks are required to take the side thrust forces imposed on the dies, *Fig.* 12. Lock dies are both difficult and expensive to manufacture, sometimes as much as doubling the die cost. In many instances, however, there is no choice in producing the part and then the additional die expense must be balanced against finishing factors such as machining and other costs required if the part were to be produced another way.

Another device frequently used to reduce forging costs is the production of individual parts in pairs.

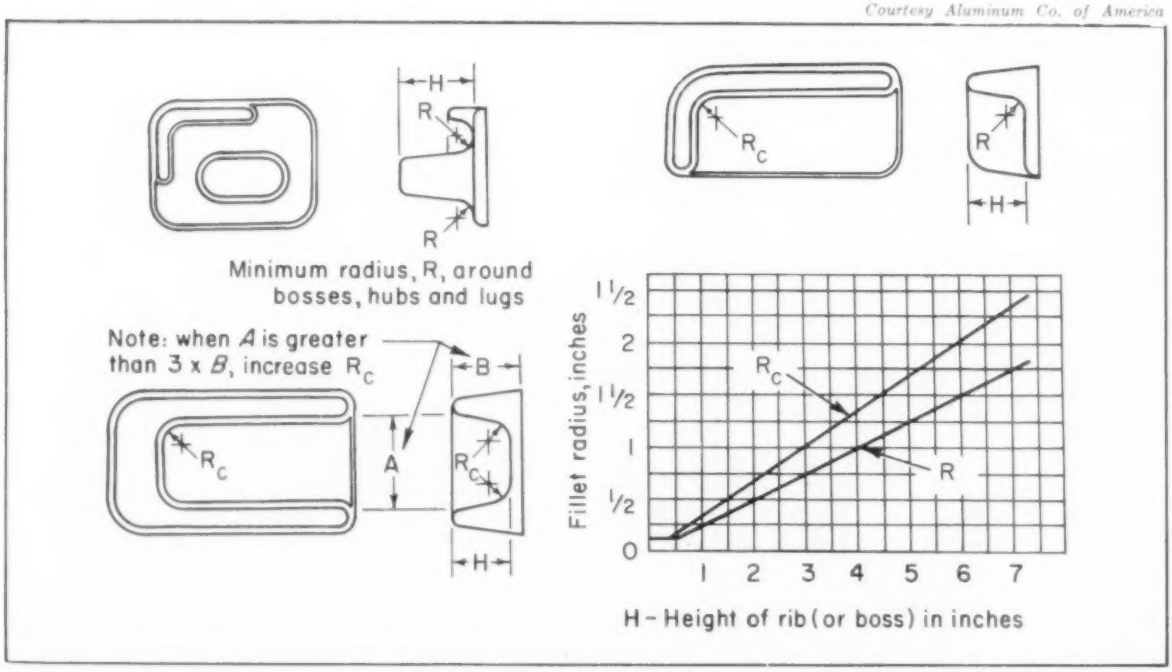
**Fig. 13. Constant draft angle, fillet radius, edge width and edge radius simplify die sinking**




*Courtesy Aluminum Co. of America*

**Fig. 14. Minimum fillet radii on ribs and bosses; *R*, where metal is confined and for plan views, *R* where metal is unconfined. Sizes of fillet radii are governed by *H*, height of rib or boss above next level on the forging.**

*Courtesy Aluminum Co. of America*



Such double forgings often solve manufacturing problems as well and should be considered when symmetrically right and left hand parts are to be produced.

Fillets and radii are also important in securing forgings free from defects. They should be held constant where possible, *Fig.* 13. Small fillets may cause unfilled sections laps and cold shuts. Minimum fillet radii for ribs and bosses in aluminum forgings are shown in *Fig.* 14. Constant corner radii on forgings saves time in die making, so blending corner radii on forgings should be avoided where possible. This is even more important than avoiding blends in fillets. Sharp edges or corners on forgings must be shaped by corresponding sharp fillet in the die. To fill properly, excessive forging pressures are required causing problems of stress concentrations. This may develop checking or the formation of small cracks in the die after a prohibitively short life. This is why full radii at edges of ribs and well-rounded corners on other sections are essential to forging economy. Minimum corner and edge radii recommendations appear in the chart shown in *Fig.* 15.

Other important factors to be considered in forging production are thin webs and ribs which require extra care, especially in nonferrous parts. These sections cool rapidly in forging dies and need repeated blows or high pressures to bring them down to size. Again, this imposes excessive strain on dies and equipment and causes other difficulties. Webs of nonferrous parts should be at least as thick as shown in *Fig.* 16.

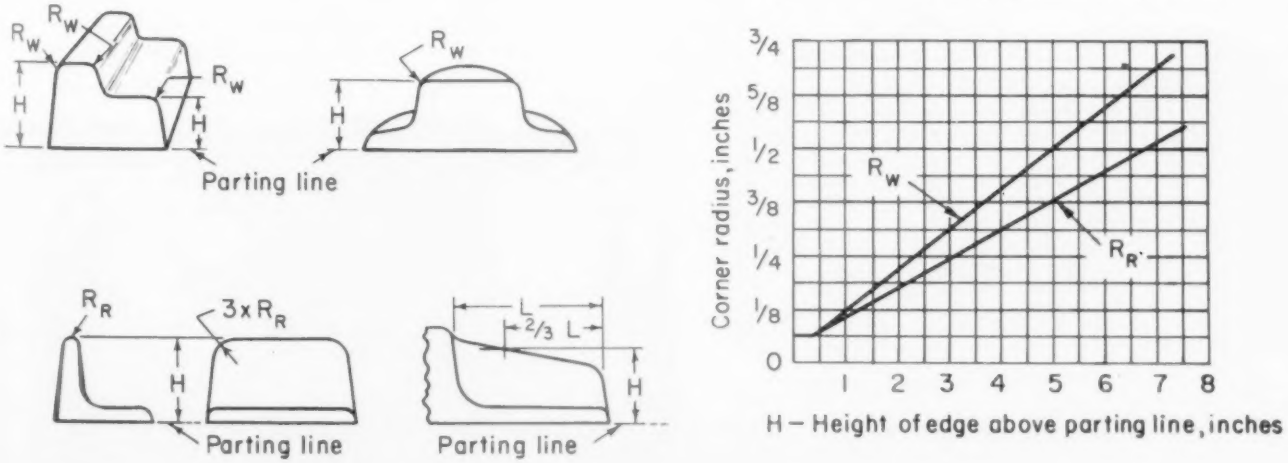
Punch-out holes can solve certain forging problems or serve functional purposes, reducing finished part costs. Deep pockets and recesses should be avoided. Grain flow should conform to the shape of the piece to secure the proper quality and potential high strength attainable in forgings, *Fig.* 17. When forging design and die design are properly worked out, the fibrous metal grain should be lined up parallel to the most severe stresses and shock loads that would be imposed on the part.

The six types of impressions ordinarily used in dies for drop forging include:

1. SWAGER for reducing a drawing out stock when differences in cross sections of forgings make it necessary. This is similar to the operation performed in the helve hammer. Swager, however, is generally used for forgings having only a short section.
2. AGER or roller distributes stock so it will fill the next impression without excessive waste.
3. BENDER impression is used when curves or angles make it necessary to bend the stock before it will properly fit the finishing impressions.
4. BLOCKER gives the forging a general shape and allows gradual flow of metal necessary to prevent laps and cold shuts. This impression may have the same contours as the finished part but large radii and fillets are added to permit easiest metal flow.
5. FINISHER impression, then, brings the forging to

**Fig. 15. Minimum corner radius of bosses, wide flanges, etc. is shown as $R_w$; minimum edge radii of ribs as $R_r$. On tapered ribs use height at 2/3 point as shown on right diagram.**

*Courtesy Aluminum Co. of America*



final size. A gutter is cut in the block around this impression to provide space for excess metal or flash that is forced out when the forging is hammered to size.

6. CUT-OFF severs the forging from the bar by shearing off the tong hold. It is used principally for small forgings where no further processing needs to be performed at the forging heat, permitting rapid and economical production.

Shrinkage is another factor with steel forgings, dimensional checking casts taken from the final impression have practically none. On the other hand steel cooling from the forging heat of 2100 to 2400 F, shrinks $\frac{3}{16}$ inch per foot or $\frac{1}{64}$ inch per inch and corresponding allowances must be made in the die impressions.

## Recent Developments

Newer equipment such as the air-lift hammer is more efficient than the older board hammer, giving economy of operation, increased production due to more strokes per minute, better control and a reduction in maintenance costs. Many producers are achieving greater efficiency through improvements in auxiliary equipment, such as furnaces, automatic controls, stock handling equipment, and other means of mechanization. These possibilities seem to offer the best opportunities for greater production. For instance, newer gas and induction types of pusher and rotary furnaces have been found to give more volume, better fuel economy, more uniform heat and increased die life. The box furnace appears to be preferred for large, heavy production, however. Automation of long production runs with elimination of manual handling seems a distinct possibility, though scale is a problem.

Statistical quality control appears to be especially adaptable to forging operations and is being employed, particularly in long run automotive plants, to control weight, straightness, length, heat treatment and other elements. Quality control stations in the shop have been found to result in lengthened die life and substantial reductions in scrap. Grading of uncut stock for varying tolerances also gives greater die life.

Other developments include new tailor-made alloys, adoption of multiple-spindle machines for die sinking and more extensive use of tracer controls, increased die life from more complete knowledge of die design principles and of plastic flow of metals. More effective utilization of existing equipment through better equipment arrangement and general plant layout has also been found to reduce handling costs and promote greater efficiency.

## Acknowledgments

The helpful cooperation of the following companies in supplying information is gratefully acknowledged:

Aluminum Co. of America.....Pittsburgh, Pa.
Billings and Spencer Co.....Hartford, Conn.
Chambersburg Engineering Co.....Chambersburg, Pa.
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Forging Mfgs. Assn. .....New York, N. Y.
Harnischfeger Corp. .....Milwaukee, Wis.
Heppenstall Corp. .....Pittsburgh, Pa.
Interstate Drop Forge Co.....Milwaukee, Wis.
Letts Drop Forge, Inc.....Detroit, Mich.
Steel Improvement & Forge Co.....Cleveland, Ohio
Utica Drop Forge & Tool Corp.....Utica, N. Y.

*Courtesy Aluminum Co. of America*

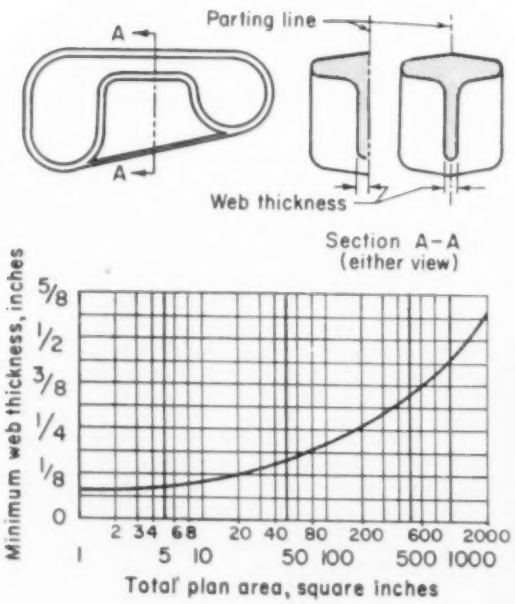
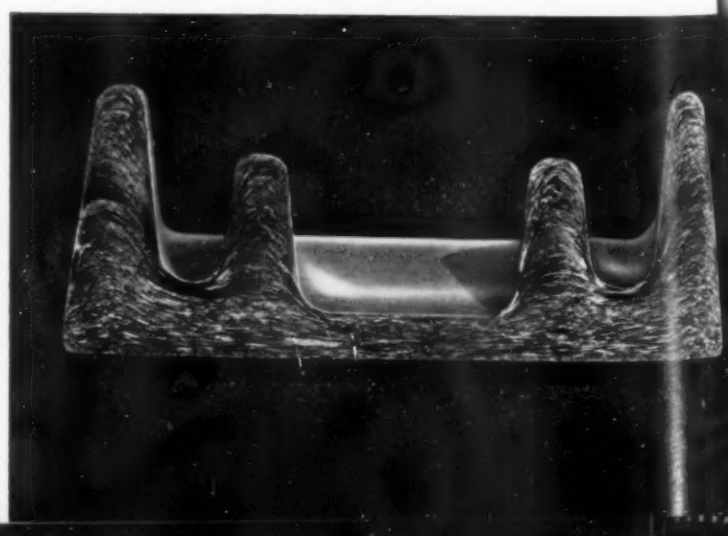



**Fig. 16. (left) Minimum web thickness in nonferrous forgings are limited by total plan area as shown in diagrams, excluding punch-outs.**

**Fig. 17. (below) Dies should be designated to produce the desired grain flow pattern in the part as shown here, to secure greatest strength in the part.**

*Photo courtesy Aluminum Co. of America*



# A-C Motor Dimensions

In the National Electrical Manufacturers Association standards for motors, mounting dimensions, shaft height and extension, and dimensions are standardized. This permits replacement of one manufacturer's motor with that of another. However, outline dimensions—including overall height, width and length—are not standardized but are generally comparable for motors made by different manufacturers. Because these standards involve substantial changes in motor design and considerable retooling by manufacturers, the new motors may not be generally available until the following dates, though some manufacturers may produce them earlier.

| Frame Number | Date |
|---|---|
| 182 and 184 | January 1, 1954 |
| 213 and 215 | June 1, 1954 |
| 254U and 256U | November 1, 1954 |
| 284U and 286U | April 1, 1955 |
| 324U and 326U | September 1, 1955 |

These new frame sizes, shown in the accompanying tables, are appreciably smaller, being approximately half the size of former frames. The new motors will have exactly the same NEMA characteristics and ratings as the old standards. Because these motors are smaller, rotor inertia will be reduced. This is advantageous for many applications involving frequent starting or reversing.

Characteristics of designs A, B and C motors, tabulated in the chart for polyphase squirrel-cage motors, are briefly:

Design A: Normal starting torque, extra-high overload torque, high starting current. For high peak running loads.

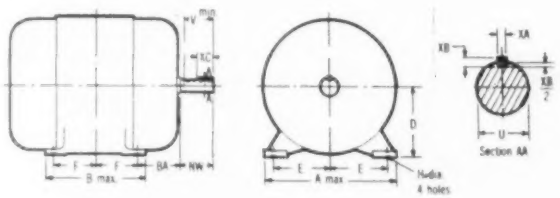
Design B: Normal starting torque, high overload torque (200-275 percent) low starting current. For general purpose applications.

Design C: High starting torque (200-250 percent), medium overload torque (190-225 percent), low starting current. For starting heavy loads. Not suitable for frequent starting applications.

These charts are presented through the courtesy of Westinghouse Electric Corp.

Old Frame Dimensions

New Frame Dimensions




## Single-Phase Motors

**General-Purpose, Foot-Mounted, Open Type, 40 deg C, 60 Cycles, 115 and 230 Volts**

| Horsepower Ratings at Given RPM 3600 | 1800 | 1200 | Frame Number | A (Max.) | B (Max.) | D | E | F | BA | H | N-W | U | V (Min.) | XA | XB | XC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 203 | 10 | 7½ | 5 | 4 | 2¾ | 3⅛ | 13/32 | 2¼ | ¾ | 2 | 3/16 | 3/16 | 1⅜ |
| 1½ | 1 | — | 182 | 9 | 6½ | 4½ | 3¾ | 2¼ | 2¾ | 13/32 | 2¼ | ⅞ | 2 | 3/16 | 3/16 | 1⅜ |
| | | | 204 | 10 | 8½ | 5 | 4 | 3¼ | 3⅛ | 13/32 | 2¼ | ¾ | 2 | 3/16 | 3/16 | 1⅜ |
| 2 | 1½ | ¾ | 184 | 9 | 7½ | 4½ | 3¾ | 2¾ | 2¾ | 13/32 | 2¼ | ⅞ | 2 | 3/16 | 3/16 | 1⅜ |
| | | | 224 | 11 | 8¾ | 5½ | 4½ | 3⅜ | 3½ | 13/32 | 3 | 1 | 2¾ | ¼ | ¼ | 2 |
| 3 | 2 | 1 | 213 | 10½ | 7½ | 5¼ | 4¼ | 2¾ | 3½ | 13/32 | 3 | 1⅛ | 2¾ | ¼ | ¼ | 2 |
| | | | 225 | 11 | 9½ | 5½ | 4½ | 3¾ | 3½ | 13/32 | 3 | 1 | 2¾ | ¼ | ¼ | 2 |
| 5 | 3 | 1½ | 215 | 10½ | 9 | 5¼ | 4¼ | 3½ | 3½ | 13/32 | 3 | 1⅛ | 2¾ | ¼ | ¼ | 2 |
| | | | 254 | 12½ | 10¾ | 6¼ | 5 | 4⅛ | 4¼ | 17/32 | 3⅜ | 1⅛ | 3⅛ | ¼ | ¼ | 2⅜ |
| 7½ | 5 | — | 254 U | 12½ | 10¾ | 6¼ | 5 | 4⅛ | 4¼ | 17/32 | 3¾ | 1⅜ | 3½ | 5/16 | 5/16 | 2¾ |
| | | | * | | | | | | | | | | | | | |
| — | 7½ | — | 256 U | 12½ | 12½ | 6¼ | 5 | 5 | 4¼ | 17/32 | 3¾ | 1⅜ | 3½ | 5/16 | 5/16 | 2¾ |

*No previous standard. Note: All dimensions in inches

## Polyphase Squirrel-Cage Motors Designs A, B and C

**Foot-Mounted Open-Type, 40 deg C; Totally-Enclosed, Fan Cooled, 55 deg C; 60 Cycles, 550 Volts and Less**

| Horsepower Ratings at Given RPM | | | | | | Frame | A | B | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3600** | 1800 | 1200 | 900 | 720 | 600 | Number | (Max.) | (Max.) | D | E | F | BA | H | N-W | U | V (Min.) | XA | XB | XC |
| | | | | | | 203 | 10 | 7½ | 5 | 4 | 2¾ | 3⅛ | 13/32 | 2¼ | ¾ | 2 | 3/16 | 3/16 | 1⅜ |
| 1½ | 1 | ¾ | — | — | — | 182 | 9 | 6½ | 4½ | 3¾ | 2¼ | 2¾ | 13/32 | 2¼ | ⅞ | 2 | 3/16 | 3/16 | 1⅜ |
| | | | | | | 204 | 10 | 8½ | 5 | 4 | 3¼ | 3⅛ | 13/32 | 2¼ | ¾ | 2 | 3/16 | 3/16 | 1⅜ |
| — | — | — | ½ | — | — | 182 | 9 | 6½ | 4½ | 3¾ | 2¼ | 2¾ | 13/32 | 2¼ | ⅞ | 2 | 3/16 | 3/16 | 1⅜ |
| | | | | | | 204 | 10 | 8½ | 5 | 4 | 3¼ | 3⅛ | 13/32 | 2¼ | ¾ | 2 | 3/16 | 3/16 | 1⅜ |
| 2 | 1½ | 1 | — | — | — | 184 | 9 | 7½ | 4½ | 3¾ | 2¾ | 2¾ | 13/32 | 2¼ | ⅞ | 2 | 3/16 | 3/16 | 1⅜ |
| | | | | | | 224 | 11 | 8⅜ | 5½ | 4½ | 3⅜ | 3½ | 13/32 | 3 | 1 | 2¾ | ¼ | ¼ | 2 |
| 3 | 2 | 1½ | ¾ | — | — | 184 | 9 | 7½ | 4½ | 3¾ | 2¾ | 2¾ | 13/32 | 2¼ | ⅞ | 2 | 3/16 | 3/16 | 1⅜ |
| | | | | | | 225 | 11 | 9½ | 5½ | 4½ | 3¾ | 3½ | 13/32 | 3 | 1 | 2¾ | ¼ | ¼ | 2 |
| 5 | 3 | 2 | 1 | — | — | 213 | 10½ | 7½ | 5¼ | 4¼ | 2¾ | 3½ | 13/32 | 3 | 1⅛ | 2¾ | ¼ | ¼ | 2 |
| | | | | | | 254 | 12½ | 10¾ | 6¼ | 5 | 4⅛ | 4¼ | 17/32 | 3⅜ | 1⅛ | 3⅛ | ¼ | ¼ | 2⅜ |
| — | — | — | 1½ | 1 | — | 213 | 10½ | 7½ | 5¼ | 4¼ | 2¾ | 3½ | 13/32 | 3 | 1⅛ | 2¾ | ¼ | ¼ | 2 |
| | | | | | | 254 | 12½ | 10¾ | 6¼ | 5 | 4⅛ | 4¼ | 17/32 | 3⅜ | 1⅛ | 3⅛ | ¼ | ¼ | 2⅜ |
| 7½ | 5 | 3 | 2 | 1½ | 1 | 215 | 10½ | 9 | 5¼ | 4¼ | 3½ | 3½ | 13/32 | 3 | 1⅛ | 2¾ | ¼ | ¼ | 2 |
| | | | | | | 284 | 14 | 12½ | 7 | 5½ | 4¾ | 4¾ | 17/32 | 3¾ | 1¼ | 3½ | ¼ | ¼ | 2¾ |
| 10 | 7½ | 5 | 3 | 2 | 1½ | 254 U | 12½ | 10¾ | 6¼ | 5 | 4⅛ | 4¼ | 17/32 | 3¾ | 1⅜ | 3½ | 5/16 | 5/16 | 2¾ |
| | | | | | | 324 | 16 | 14 | 8 | 6¼ | 5¼ | 5¼ | 21/32 | 4⅞ | 1⅝ | 4⅝ | ⅜ | ⅜ | 3¾ |
| 15 | 10 | 7½ | 5 | 3 | 2 | 256 U | 12½ | 12½ | 6¼ | 5 | 5 | 4¼ | 17/32 | 3¾ | 1⅜ | 3½ | 5/16 | 5/16 | 2¾ |
| DP* | TEFC† | DP* | TEFC† | | | | | | | | | | | | | | | | |
| 20 | — | 15 | 15 | 10 | 7½ | — | — | 326 | 16 | 15½ | 8 | 6¼ | 6 | 5¼ | 21/32 | 4⅞ | 1⅝ | 4⅝ | ⅜ | ⅜ | 3¾ |
| | | | | | | 284 U | 14 | 12½ | 7 | 5½ | 4¾ | 4¾ | 17/32 | 4⅞ | 1⅝ | 4⅝ | ⅜ | ⅜ | 3¾ |
| | | | | | | 326 | 16 | 15½ | 8 | 6¼ | 6 | 5¼ | 21/32 | 4⅞ | 1⅝ | 4⅝ | ⅜ | ⅜ | 3¾ |
| — | 20 | — | — | — | — | 286 U | 14 | 14 | 7 | 5½ | 5½ | 4¾ | 17/32 | 4⅞ | 1⅝ | 4⅝ | ⅜ | ⅜ | 3¾ |
| | | | | | | 364 | 18 | 15¼ | 9 | 7 | 5⅝ | 5⅞ | 21/32 | 5⅝ | 1⅞ | 5⅜ | ½ | ½ | 4¼ |
| — | — | 20 | 20 | — | 10 | 286 U | 14 | 14 | 7 | 5½ | 5½ | 4¾ | 17/32 | 4⅞ | 1⅝ | 4⅝ | ⅜ | ⅜ | 3¾ |
| | | | | | | 364 S | 18 | 15¼ | 9 | 7 | 5⅝ | 5⅞ | 21/32 | 3¼ | 1⅝ | 3 | ⅜ | ⅜ | 1⅞ |
| 25 | — | — | — | — | — | 286 U | 14 | 14 | 7 | 5½ | 5½ | 4¾ | 17/32 | 4⅞ | 1⅝ | 4⅝ | ⅜ | ⅜ | 3¾ |
| | | | | | | 364 | 18 | 15¼ | 9 | 7 | 5⅝ | 5⅞ | 21/32 | 5⅝ | 1⅞ | 5⅜ | ½ | ½ | 4¼ |
| — | — | 25 | — | 15 | — | 324 U | 16 | 14 | 8 | 6¼ | 5¼ | 5¼ | 21/32 | 5⅝ | 1⅞ | 5⅜ | ½ | ½ | 4¼ |
| | | | | | | 364 S | 18 | 15¼ | 9 | 7 | 5⅝ | 5⅞ | 21/32 | 3¼ | 1⅝ | 3 | ⅜ | ⅜ | 1⅞ |
| 30 | — | — | — | — | — | 324 S | 16 | 14 | 8 | 6¼ | 5¼ | 5¼ | 21/32 | 3¼ | 1⅝ | 3 | ⅜ | ⅜ | 1⅞ |
| | | | | | | 365 | 18 | 16¼ | 9 | 7 | 6⅛ | 5⅞ | 21/32 | 5⅝ | 1⅞ | 5⅜ | ½ | ½ | 4¼ |
| — | — | 30 | 25 | 20 | 15 | 326 U | 16 | 15½ | 8 | 6¼ | 6 | 5¼ | 21/32 | 5⅝ | 1⅞ | 5⅜ | ½ | ½ | 4¼ |
| | | | | | | 365 S | 18 | 16¼ | 9 | 7 | 6⅛ | 5⅞ | 21/32 | 3¼ | 1⅝ | 3 | ⅜ | ⅜ | 1⅞ |
| 40 | 25 | — | — | — | — | 326 S | 16 | 15½ | 8 | 6¼ | 6 | 5¼ | 21/32 | 3¼ | 1⅝ | 3 | ⅜ | ⅜ | 1⅞ |

**Design A and B only. *DP = Drip Proof Motors. † TEFC = Totally Enclosed Fan Cooled Motors. Note: All dimensions in inches

## Polyphase Wound-Rotor Motors

**General-Purpose, Foot-Mounted, Open Type, 40 degC, 60 Cycles, 550 Volts and Less**

| Horsepower Ratings at Given RPM | | | Frame | A | B | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1800 | 1200 | 900 | Number | (Max.) | (Max.) | D | E | F | BA | H | N-W | U | V (Min.) | XA | XB | XC |
| | | | 224 | 11 | 8¾ | 5½ | 4½ | 3⅜ | 3¼ | 13/32 | 3 | 1 | 2¾ | ¼ | ¼ | 2 |
| 2 | | | 213 | 10½ | 7½ | 5¼ | 4¼ | 2¾ | 3½ | 13/32 | 3 | 1⅛ | 2¾ | ¼ | ¼ | 2 |
| | | | * | | | | | | | | | | | | | |
| — | 1½ | ¾ | 213 | 10½ | 7½ | 5¼ | 4¼ | 2¾ | 3½ | 13/32 | 3 | 1⅛ | 2¾ | ¼ | ¼ | 2 |
| | | | 225 | 11 | 9½ | 5½ | 4½ | 3¾ | 3½ | 13/32 | 3 | 1 | 2¾ | ¼ | ¼ | 2 |
| 3 | 2 | 1 | 215 | 10½ | 9 | 5¼ | 4¼ | 3½ | 3½ | 13/32 | 3 | 1⅛ | 2¾ | ¼ | ¼ | 2 |
| | | | 254 | 12½ | 10¾ | 6¼ | 5 | 4⅛ | 4¼ | 17/32 | 3⅜ | 1⅛ | 3⅛ | ¼ | ¼ | 2⅜ |
| 5 | 3 | 1½ & 2 | 254 U | 12½ | 10¾ | 6¼ | 5 | 4⅛ | 4¼ | 17/32 | 3¾ | 1⅜ | 3½ | 5/16 | 5/16 | 2¾ |
| | | | 284 | 14 | 12½ | 7 | 5½ | 4¾ | 4¾ | 17/32 | 3¾ | 1¼ | 3½ | ¼ | ¼ | 2¾ |
| 7½ | 5 | 3 | 256 U | 12½ | 12½ | 6¼ | 5 | 5 | 4¼ | 17/32 | 3¾ | 1⅜ | 3½ | 5/16 | 5/16 | 2¾ |
| | | | 324 | 16 | 14 | 8 | 6¼ | 5¼ | 5¼ | 21/32 | 4⅞ | 1⅝ | 4⅝ | ⅜ | ⅜ | 3¾ |
| 10 | 7½ | 5 | 284 U | 14 | 12½ | 7 | 5½ | 4¾ | 4¾ | 17/32 | 4⅞ | 1⅝ | 4⅝ | ⅜ | ⅜ | 3¾ |
| | | | 326 | 16 | 15½ | 8 | 6¼ | 6 | 5¼ | 21/32 | 4⅞ | 1⅝ | 4⅝ | ⅜ | ⅜ | 3¾ |
| 15 | 10 | 7½ | 324 U | 16 | 14 | 8 | 6¼ | 5¼ | 5¼ | 21/32 | 5⅝ | 1⅞ | 5⅜ | ½ | ½ | 4¼ |
| | | | 365 | 18 | 16¼ | 9 | 7 | 6⅛ | 5⅞ | 21/32 | 5⅝ | 1⅞ | 5⅜ | ½ | ½ | 4¼ |
| — | 15 | 10 | 326 U | 16 | 15½ | 8 | 6¼ | 6 | 5¼ | 21/32 | 5⅝ | 1⅞ | 5⅜ | ½ | ½ | 4¼ |
| | | | 364 | 18 | 15¼ | 9 | 7 | 5⅝ | 5⅞ | 21/32 | 5⅝ | 1⅞ | 5⅜ | ½ | ½ | 4¼ |
| 20 | — | — | 326 U | 16 | 15½ | 8 | 6¼ | 6 | 5¼ | 21/32 | 5⅝ | 1⅞ | 5⅜ | ½ | ½ | 4¼ |

*No previous standard. Note: All dimensions in inches

# news

# featured this month


Bellamy Named General Manager . . . . . 93
Coming Meetings . . . . . 104
Madison Sponsors Three-Day Institute . . . . . 91
McKenna Receives ASME Award . . . . . 92
New Member for the Education Committee . . . . . 99
Positions Available . . . . . 105
Positions Wanted . . . . . 101
Third Conference Held in Illinois . . . . . 88
Tigges Elected President of NMTBA . . . . . 92
Waindle Appoints New Committee . . . . . 98
Wilcox Awarded U of M Citation . . . . . 99



Albuquerque . . . . . 102
Baltimore . . . . . 100
Binghamton . . . . . 101
Boston . . . . . 105
Central Pennsylvania . . . . . 101
Chautauqua-Warren . . . . . 99
Chicago . . . . . 104
Cincinnati . . . . . 94, 102
Cleveland . . . . . 99
Columbus . . . . . 94
Dayton . . . . . 102
Denver . . . . . 106
Detroit . . . . . 106
Elmira . . . . . 106
Erie . . . . . 100
Evansville . . . . . 101
Fond du Lac . . . . . 95
Fort Wayne . . . . . 105
Fox River Valley . . . . . 99
Golden Gate . . . . . 92
Grand River Valley . . . . . 93
Granite State . . . . . 95
Greater Lancaster . . . . . 94
Greater New York . . . . . 105
Hamilton District . . . . . 103
Hartford . . . . . 103
Indianapolis . . . . . 97
Kansas City . . . . . 93
Keystone . . . . . 103
Lehigh Valley . . . . . 102
Lima, Ohio . . . . . 96, 103
Little Rhody . . . . . 100
Long Beach . . . . . 106
Long Island . . . . . 96
Los Alamos . . . . . 98
Louisville . . . . . 93
Mid-Hudson . . . . . 105
Milwaukee . . . . . 106
Nashville . . . . . 98
New Haven . . . . . 99
New Orleans . . . . . 106
Niagara District . . . . . 100
North Texas . . . . . 98
Northern Massachusetts . . . . . 101
Peoria . . . . . 96
Peterborough . . . . . 105
Philadelphia . . . . . 101
Piedmont . . . . . 100
Pittsburgh . . . . . 101
Portland, Me. . . . . 96
Racine . . . . . 102
Richmond . . . . . 93
Rochester . . . . . 102, 106
Rockford . . . . . 97
Saginaw Valley . . . . . 102
St. Louis . . . . . 95
Salt Lake City . . . . . 100
San Diego . . . . . 98
San Fernando Valley . . . . . 97
San Gabriel Valley . . . . . 105
Santa Clara Valley . . . . . 106
South Bend . . . . . 103
Springfield, Ill. . . . . 96
Springfield, Ohio . . . . . 92
Springfield, Mass. . . . . 98
Toledo . . . . . 99
Toronto . . . . . 95
Twin Cities . . . . . 84
Tri-Cities . . . . . 93
Twin States
Keene Co-Chapter . . . . . 106
Wichita . . . . . 100, 106
Williamsport . . . . . 95

This aerial view shows the heart of Philadelphia, ASTE's convention city for the 1954 Industrial Exposition and Annual Meeting.

# Make Plans Now to Attend ASTE's Industrial Exposition

## April 26-30, 1954

It looks like the biggest week in ASTE history.

A complete sellout of space at an unusually early date—utilization of every available display area—more exhibitors than ever before—technical programs presented by more than 50 outstanding engineers—these are just a few of the indications that April 26 through 30, the dates of ASTE's 1954 Industrial Exposition and Annual Meeting in Philadelphia, will see new records written by the American Society of Tool Engineers.

### Exhibit Area Expanded

The original exhibit area of 134,000 square feet was expanded to 155,000 when applications from industrial firms from Maine to California poured in at an unprecedented rate. Space allocations are now completed and more than 450 exhibitors will be on hand when the exposition opens to show the latest tools, tooling, attachments and accessories.

Added to the educational impact of the exposition itself is the varied program of sessions featuring panel discussions, paper presentations, forums and films on current topics of vital importance to all members of the engineering profession.

Each of the five days has been designated for special emphasis on a particular phase of production. On Monday plant management will be stressed. Tuesday programs will feature automation. Wednesday will emphasize cutting and grinding. Thursday will see precision control in the spotlight and on Friday it will be forming and assembling. There will be something for everyone to see and to learn every day of the week.

A special feature during the week of the show will be the Carbide Workshop to be held every morning at the University of Pennsylvania. The National Education Committee, under Chairman Arthur R. Diamond, with the help of Campbell Pittsinger,

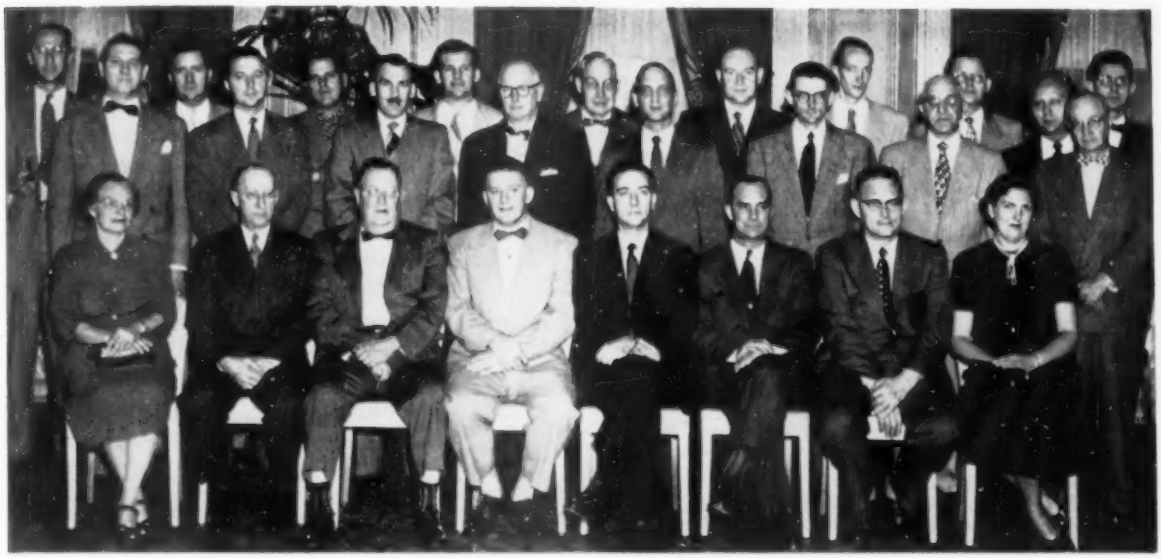
head of the Philadelphia chapter, is sponsoring the educational project.

In discussing the 1954 industrial exposition, Harry E. Conrad, executive secretary of the Society said, "In addition to the nationwide recognition given our shows, this year's exposition has added significance because it will be held in the heart of today's exciting industrial expansion in the Delaware Valley.

activities is being handled by Roy Paulsen, William Chalfont and William Pinkstone.

Supplementary functions such as transportation, housing, registration, tickets, and display of signs will be supervised by Richard D. Gross, John Locke, Jr., Paul Mochel, Charles Brogan, Jr., Allen B. Taylor, Fred Hetrick, M. Willard Davies, Jack Schroth and Karl K. Rauch.

**At a recent meeting of the Philadelphia chapter committee and the National Program Committee, these members got together to make convention plans. From left, back row, are: Kenneth Riddle, D. C. Taylor, William Chalfont, J. H. Locke, M. Dell, Campbell Pittsinger, Karl Rauch, Richard Bacik, and Jack Schroth. Middle row: W. J. Pinkstone, Robert Mason, M. W. Davies, Ralph Chrissie, Fred Hetrick, Charles Brogan, Paul Mochel, Walter Phifer, and Tom Barber. Seated: Mrs. Roy Paulsen, H. W. Gross, Roy Paulsen, E. H. Wheeler, Edmund Hollingsworth, Robert Lowry, Richard Gross, and Mrs. Dorothy Kitzman.**



A number of ASTE business meetings are also on the calendar for the last week in April. The House of Delegates, with representatives from every chapter, will convene to elect members to the 1954-55 Board of Directors. And at their annual meeting, the national directors will name the officers who will guide ASTE activities during the coming year.

**Philadelphia Committee**

Paralleling activities planned by the National Program Committee are those in the hands of the Philadelphia chapter committee, which met recently with NPC to map plans for plant tours, session facilities, ladies programs and other events.

Edmund Hollingsworth is general chairman of the Committee. Assisting him are Kenneth W. Riddle (also chairman of the NPC), Edward H. Wheeler and Howard W. Gross.

Social programs will be arranged by Robert Lowry, Robert Mason, John Moorhouse, Walter Phifer, Edward Rauss, Mrs. Dorothy Kitzman and Mrs. Roy Paulsen. The job of coordinating technical

A full program of ladies' activities is being planned for ASTE wives joining their husbands in Philadelphia for convention week. Arrangements are being completed for luncheons, tours, and visits to the famed historical landmarks in the city of brotherly love.

**PHILADELPHIA CONVENTION CENTER**
**will be the scene of this year's**
**ASTE EXPOSITION**

# Third Annual ASTE Conference Held in Illinois

Speakers at the ASTE luncheon included: N. A. Parker, head of the department of mechanical engineering; Harry A. Paine, chairman of the Chicago chapter and the conference committee; W. L. Everitt, dean of the College of Engineering; and Roger F. Waindle, national president of the Society.

The University of Illinois at Urbana again provided its facilities on November 14 for the ASTE Tool Engineering Conference. It was the third annual meeting conducted by the Illinois chapters of the Society and the university's department of mechanical engineering.

Registration for the all-day technical program and activities for the ladies totaled 80 engineers and their wives. All were invited to attend the informal dinner held at the Urbana-Lincoln Hotel.

Featured speaker at this event was Dr. H. J. Fuller of the university staff who presented an address entitled "Education for What?" Toastmaster was K. J. Trigger, professor of mechanical engineering.

At the luncheon meeting, ASTE was welcomed to the Illinois campus by W. L. Everitt, dean of the College of Engineering. In reply Roger F. Waindle, national president, extended the appreciation of the Society for the generous help of the university.

Brief talks were also made by Joseph P. Crosby, first vice president of ASTE, and Howard C. McMillen, third vice president of the Society.

Participants in the panel discussion on automation were, from left: J. H. Mansfield, consultant engineer, Greenlee Bros. & Co.; M. J. Murphy, editor of *Factory Management and Maintenance*; and Harry Conn, chief engineer, Scully-Jones & Co. L. C. Pigage and L. E. Doyle, far right, associate professors of mechanical engineering, were sessions chairmen.

Tours of the College of Engineering were conducted by student guides. Here the ASTE visitors learn about the facilities in the machine shop.

National membership and education programs were covered by C. D. Wright, member of the National Education Committee; Joseph P. Crosby, first vice president of ASTE; Marvin Bunting, standing, national committee secretary; Arthur R. Diamond, chairman of the NEC; Prof. J. N. Edmondson, NEC member; and Andy Clark, chairman of the National Membership Committee.

A serious discussion gets the full attention of Howard C. McMillen, ASTE third vice president; Prof. Orville D. Lascoe, member of the National Education Committee; and Thomas C. Barber, member of the National Program Committee.

The day's program is scanned at the education committee meeting by C. D. Wright, Prof. Myron L. Begeman; Prof. Robert E. McKee and Prof. Frederick Preator. The committee held its meeting while the technical lectures were being presented.

Interested listeners at the dinner meeting were: Fred L. Todd of the Madison Vocational School, and Dr. A. O. Schmidt, research engineer, Kearney and Trecker Corp., and one of the institute lecturers.

W. R. Heins of Gisholt Machine Co. gives a demonstration for Leonard Mueller, Ohio Chemical & Surgical Equipment Co., and W. I. Senger, vice president at Gisholt.

This group of Madison ASTE members includes: A. J. Mergen, editorial chairman; Larry Ellis; E. J. Skidmore, second vice chairman; Fred Kessenich, past chairman; E. C. Helmke, chapter chairman; and Robert O. Morehead, secretary.

Conference leaders and staff members were: George R. Sell, institute coordinator; Roy A. Lindberg, assistant professor, mechanical engineering; Charles A. Gilpin, associate professor, mechanical engineering; E. J. Skidmore, Madison ASTE officer; J. A. Gage; associate professor, mechanical engineering; E. C. Helmke, ASTE officer; Dr. A. O. Schmidt; and Paul J. Grogan, director of engineering institutes.

**A group picture shows the institute instructors and students who participated in the conference.**

# Madison Sponsors Three-Day Institute on Tool Engineering

Under the joint sponsorship of the Madison ASTE chapter and the University of Wisconsin, the 1953 Institute on Tool Engineering held on November 18 through 20 drew a record registration of 53 engineers. Five states were represented—Connecticut, Indiana, Illinois, Ohio and Wisconsin.

Sessions at the three-day meeting were held in the new engineering building on the University of Wisconsin campus at Madison.

A special dinner was held at Maple Bluff Country Club for those participating in the institute and members of the members of the Madison chapter.

The technical program at the dinner was presented by R. F. Farley, regional supervisor, Industrial Products Department, Johnson Wax Co. He discussed wax lubricants for metal working. Coffee speaker was Lieut. R. A. Golden, public relations officer for the Air Force at Truax Field, Madison.

**R. R. Larson, left, receive registration material from George Sell, institute coordinator of the university extension division staff. C. E. Helmke, chairman of the Madison chapter, is pictured at the far right.**

**Certificates were awarded to all those who attended the conference. Here Arnold F. Griswold, instructor in mechanical engineering at the university makes three presentations at the close of the conference.**

## Herbert Tigges Elected President of National Machine Tool Builders

Herbert L. Tigges, executive vice president, Baker Brothers, Inc., Toledo, Ohio, was elected president of the National Machine Tool Builders' Association at its 52nd annual meeting held in November at the Boca Raton Hotel and Club in Florida. He is past president of ASTE.

Milburn a Hollengreen, president and general manager, Landis Tool Co., Waynesboro, Pa., was elected first vice president; and Louis Polk, president of The Sheffield Corp., Dayton, Ohio, was elected second vice president and director. Mr. Polk is a member of the ASTE Research Fund Committee. John C. Gotner, president and general manager of The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, was elected treasurer.

New directors elected, in addition to Mr. Polk, were: Everett M. Hicks, vice president and manager of the Grinding Machine Division of the Norton Co., Worcester, Mass., and William E. Rutz, executive vice president and works manager, Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. Mr. Rutz is also an ASTE member.

**Herbert L. Tigges**

Tell Berna was reappointed general manager of the association and Mrs. Frida F. Welbert was re-elected secretary of the organization.

## Philip McKenna, Kennametal President, Receives Holley Medal from ASME

Philip M. McKenna, president of Kennametal Inc., Latrobe, Pa., received the Holley Medal awarded by the American Society of Mechanical Engineers at its annual meeting in New York, November 29 to December 4.

**Philip M. McKenna**

Mr. McKenna is a member of the American Society of Tool Engineers and well-known in ASTE circles as a speaker and author of articles in THE TOOL ENGINEER magazine.

The Holley Medal is awarded on occasion for a "great and unique act of genius of an engineering nature that has accomplished a great and timely public benefit." Mr. McKenna was honored for his research, development and application of cemented carbide compositions which have contributed so much to the art and science of metal-cutting.

National chairman of the Gold Standard League and an authority on monetary economics, he was also selected by ASME to deliver the Towne Lecture at the annual meeting. This marked the first time that a Holley Medal winner also had been the Towne Lecturer.

Among those who have received the Holley Medal in the past are: Henry Ford, Elmer A. Sperry, John C. Garand, Carl L. Norden and Edwin H. Land. Previous Towne lecturers have included Herbert Hoover, Gerard Swope, Charles E. Wilson, and A. W. Robertson.

## Plastic Covers for ASTE Handbooks Now Available

Plastic covers to prolong the life of your *Tool Engineers Handbook* are now available through a member of the Twin States ASTE chapter.

H. F. Blake, 15 Cottage Street, Claremont, New Hampshire, is now taking orders for the one-piece electronically sealed slip covers made of heavy, clear polyvinyl acetate. They are especially designed to protect the handbooks from accidents and heavy wear.

ASTE chapters are offered discounts and orders for ten or more covers will receive special attention. Full information on the price list and ordering instructions can be obtained by writing to Mr. Blake.

## Two Tours Necessary for Record Golden Gate Crowd

San Francisco—To handle a record crowd of 250 Golden Gate members and guests, the chapter's November tour of United Airlines Maintenance plant was held on two successive evenings. At both meetings the airlines firm served dinner to the ASTE visitors, showed them a movie entitled "United 6534," and provided guides for the extensive plant tour.

The San Francisco plant is the one major overhaul shop to which the whole United Airlines fleet returns with regular clockwork. In the period of one week, a DC-6 is stripped to its shell, motors and every movable part taken out, including rug and seats in the interior, and completely refitted and test flown. Every individual part of the motor is disassembled, inspected and replaced and reassembled.

The plant itself is one of the firm's best advertisements. Every machine is brightly painted to show dangerous moving parts in color symbols and the floors and work tables are as clean as any housewife would want her home to be. *—Philip R. Freeman*

## Cincinnati Field Trip on Springfield Agenda

Cincinnati—The November 10 meeting of the Springfield, Ohio, chapter consisted of a field trip to the Cincinnati Milling Machine Co., Cincinnati. Approximately 112 members and guests traveled by bus and car to the plant. Kenneth P. Martin, director of hydroform activities at the company, addressed the group on "The Hydroform, a New Kind of Machine Tool."

*—E. W. Carmichael*

## Tri-Cities Hears Public Relations Man

East Moline, Ill.—Tri-Cities chapter, 90 strong, turned out for the November 11 meeting at American Legion Hall. Principal speaker on the program was Emmet J. O'Connell, director of public and industrial relations Verson All-steel Press Co., Chicago.

Mr. O'Connell's talk was illustrated by two color sound films, "Tooling at Maytag" and "Transmat Presses and Tooling." A shorter film supplemented the talk entitled "Verson-Wheelon Direct Acting Press," depicting the Guerin process of rubber pad forming.

During coffee, Mrs. Mathilda Kakert, of the Moline Bell Telephone Co., presented a program, "The Man on Your Line," and played various recordings of voices to show the impression and psychological effect of a person's voice over the telephone wire.

*—Earl Tenpound*

## Rupert Esser Addresses Richmond ASTE Members

Richmond, Ind.—The Leland Hotel was the scene of the November 6 smorgasboard dinner meeting held by the Richmond chapter. After the business of electing a nominating committee, the chapter heard a talk by Rupert Esser, of the Tec Engineering Co., Logansport, Ind. His topic was "Fundamentals of Air and Hydraulic Installations." An additional guest that evening was John Dale also of Tec Engineering. *—E. Hale*

Leslie B. Bellamy

## University Professors Guests at Kansas City

Kansas City, Mo.—A number of guests were present for the November meeting of the Kansas City chapter. They included the following staff members of the University of Kansas: Ralph Tait, professor of mechanical engineering; Howard Rust, professor of shop practice; Paul Hausman, director of shop practice; and Grant Snyder, instructor of shop practice.

The technical program was offered by four representatives of the Skinner Chuck Co. of New Britain, Conn. Donald M. Stevenson, sales manager of the Chicago office, was the principal speaker. *—Richard W. Corliss*

**In charge of the program for Kansas City's November meeting were these representatives of the Skinner Chuck Co., New Britain, Conn. From left: K. H., Walther, Donald M. Stevenson, sales manager and main speaker, Dana B. Griffin, and Boyd M. Baker.**

## Past President Bellamy Named General Manager

Announcement has been made of the appointment of Leslie B. Bellamy, immediate past president of the American Society of Tool Engineers, as general manager of the Sterling Abrasives Division of The Cleveland Quarries Co. at Tiffin, Ohio.

Mr. Bellamy has been Detroit district manager for Sterling since 1946. He joined the division in 1944 as technical field engineer.

Elected national president of ASTE in March, 1952, Mr. Bellamy had previously served the Society as first vice president, national director, and chairman of the National Standards Committee. He was chairman of the Detroit chapter in 1947.

A native of Wales, he came to this country in 1928 and joined the Packard Motor Car Co. as materials specifications supervisor. Later he was chief tool research engineer for the automotive firm.

## Louisville Awards First $100 Scholarship

Louisville—The Louisville chapter awarded its first annual $100 scholarship to Ed Joe Hammer at its November 10 meeting which took place at the L & N Railroad Branch YMCA.

Mr. Hammer, a freshman at Speed Scientific School of the University of Louisville, is a graduate of Point Manual High School. The awards have been initiated to create interest in tool engineering.

The meeting was a joint one with the Louisville chapter of ASM. A technical speaker was also on the program. Tex Klaybor, associate director of research for the Allegheny-Ludlum Steel Corp., Dunkirk, N. Y., presented a talk on "The Heat Treatment and Uses of Tool Steel."

## Grand River Reviews Automatic Transmissions

Galt, Ont.—Grand River Valley's November 6 meeting was held at Shep's Hall and about 60 members and guests turned out. Harry Whittingham, vice president, Detroit Gear Division of Borg Warner Corp., assisted by Mr. Purdy of the same organization, gave a talk on "Automatic Transmissions for the Studebaker Corp."

During the business session, members elected their nominating committee for the coming elections. Selected were: Charles Spicer, David MacCready and William C. Little. *—W. C. Little*

## Co-Sponsored by Chapter and Society Committee

Lancaster—"Training and Education for the Tool Engineer" was the timely topic presented at the November meeting of the Greater Lancaster chapter. Sponsored in conjunction with the National Education Committee, the program was conducted by Arthur Diamond, committee chairman. He was assisted by Prof. W. W. Gilbert of the University of Michigan, and Prof. O. D. Lascoe and Prof. V. Daugherty of Purdue University. All are members of the ASTE committee.

Mr. Diamond

Mr. Moorehead

Prof. Gilbert

Prof. Daugherty

The discussion centered on ASTE training and education programs, including college curricula, industrial, trade school and apprentice programs.

The meeting was attended by 117 members and invited guests representing schools and colleges in the area, as well as training supervisors and other executives from industry. The session was opened by Raymond Moorhead, chairman of the Greater Lancaster chapter. *—George J. Coil*

## Emil Gairing Opens New Corporation

Emil Gairing has announced the formation of a new corporation, Emil Gairing, Inc., as consultants, designers and builders of production cutting tools and component parts. The offices of the new corporation are at 10239 Puritan Ave., Detroit 38, Mich.

**A full technical program and a dinner served in the company cafeteria greeted the 210 members and guests of the Columbus ASTE chapter who toured North American Aviation, Inc., on October 14. They saw a movie, "This is Air Power," and heard talks by Glenn Perimann, far left, chief industrial engineer at NAA; Emmett A. Bartlow, superintendent of maintenance at Ternstedt's Columbus plant and chairman of the Columbus chapter; and F. W. Westermeier, tooling superintendent at NAA.**

### *Obituary*

**Albert Schlattner,** a charter member of Cincinnati ASTE chapter, died November 9, 1953, at the age of 52, as the result of injuries received in an automobile accident near Portsmouth, Ohio.

In June, 1938, Mr. Schlattner assisted in organizing the Cincinnati chapter and had been very active in its operations, having served as chairman during the 1944-1945 season.

For years he had been vice president and works manager for the Cincinnati Gilbert Machine Tool Co. and in 1952 became a sales engineer for Kennametal, Inc.

## Dr. George A. Roberts Elected Vice President

Vanadium-Alloys Steel Co., Latrobe, Pa., has announced the election of Dr. George A. Roberts to the post of vice president in charge of technology. Dr. Roberts, formerly chief metallurgist for the company, was named to the office at a meeting of the Vanadium-Alloys board of directors.

In his new role, he will direct the firm's research and development program and head the technical staff. He joined the company in 1941 as a laboratory technician and in 1945 was named chief metallurgist.

## Columbus Hears About Vibration Elimination

Columbus—"Vibration Elimination in Machine Tools" was discussed by two executives of International Research and Development Corp. at the November meeting of the Columbus chapter. Speakers were Arthur R. Crawford, president, and Theodore Ongaro, vice president of the Columbus firm.

One of the products demonstrated at the session was the Vibratron, a portable electronic instrument which permits a relatively inexperienced person to quickly locate the cause of vibration in the machine and to locate the point of unbalance and magnitude of unbalance in rotating parts causing the vibration. *—Roscoe Small*

## Twin Cities Tours Minneapolis-Honeywell

Minneapolis — Twin Cities chapter met at Jax Cafe for dinner and a short business session on November 4. The 120 members and guests present then toured Minneapolis-Honeywell, Aeronautical Division, in Minneapolis. Members had been scheduled to tour Viking Drill Plant in St. Paul but a recent ownership change upset plans.

*—Walter J. Comstock*

## Resigns Position

Arthur E. Lynch, who has been associated with Gisholt Machine Co. for the past 28 years, has resigned his position as Milwaukee district sales representative.

## Toronto Chapter Awards $100 Scholarship

Toronto—Three events were reported by the Toronto chapter. November 13 saw a crowd of 250 turn out for the chapter's annual stag party at the Club Top Hat. Entertainment included two films "Canadian Wildlife" and "Trooping of the Colors." Several vaudeville acts were on the program. William H. Weatherhead was in charge of arrangements for the affair and Leonard Chapman planned the entertainment.

The November 4 regular monthly meeting drew 125 members and guests to the Oak Room, Union Station, Toronto. Fred Lockhart, immediate past chairman of the chapter was elected to head the nominating committee for the coming elections. Also on the committee are Walter Appleton and Jack Janzen.

Robert McKee, second year student in tool design at Ryerson Institute, was awarded a $100 scholarship as the outstanding student of the current season.

The speaker of the evening was Gustaf A. Anderson, lapping engineer, Norton Behr-Manning Inc., Worcester, Mass. "Production Lapping" was the topic of his talk. A coffee film entitled "Prelude to Kitimat" was shown, describing the preliminary work being done on the Aluminum Company of Canada's huge Kitimat project.

A plant tour of the Canadian Carborundum Co., Niagara Falls, Ontario, was also on the chapter schedule of events on October 30. The furnace room, out of bounds to all previous visitors to the plant, was of special interest to the group. The success of the trip was attributed to Robert Lawrence, program chairman, and his committee of Thomas Cathro, Bruce Fairgrieve, Eric Browne, and Chapter Chairman Dave Few. —*A. McKinney Rice*

**John A. Harrington**

## Broaching Discussed at Williamsport

Williamsport, Pa.—The November meeting of the Williamsport chapter featured a talk by Joseph A. Psenka, field engineer, National Broach and Machine Co., Detroit. His topic was "Modern Broaching Practices." The talk covered broaching principles, design, manufacturing and broaching application augmented by slides. Sixty-five were present.

Chapter Chairman William McCoy outlined plans for increasing membership, emphasizing the growth on the national level in the past few years. Special guest was Robert Reed, treasurer of Gierston Tool Co., Elmira, and a member of the Elmira chapter, who was responsible for obtaining the main speaker.

Coffee speaker was Trooper James Summerson, of the Pennsylvania State Police, who presented a talk on highway safety illustrated by a movie on safety and negligent driving.

—*John L. Balint*

## DoAll Engineer Presents 76th ASTE Program

St. Louis—Making his 76th appearance before an ASTE chapter, John A. Harrington, chief engineer at the DoAll Co., spoke November 5 to 150 ASTE members in St. Louis. His topic was "Dimensional Quality Control."

A major point emphasized by Mr. Harrington was that our extremely high national standard of living is due for the most part to our ability to duplicate component parts in a production manner through the use of dimensional quality control.

He said the most advanced industrial nations of Europe, excellent engineers, mechanics and machinery notwithstanding, still do not use dimensional control and turn out basically hand fitted production assemblies which necessarily price modern conveniences out of reach for most people.

Other parts of Mr. Harrington's discussion centered about lack of uniformity in our measurement, what is a standard inch, misunderstanding of the millionth of an inch, common mistakes made in measurements, and the necessity for constant calibration and methods of calibration.

—*E. Graser, Jr.*

## Granite State Reports Annual Ladies' Night

Porthmouth, N. H.—A social get-together was on the calendar for the Granite State chapter members and wives on November 14. The occasion was the annual Ladies' Night program held at Yoken's Restaurant. Dinner and dance music provided by Mildred Chesley and Company made an enjoyable evening reports the Granite State chapter. —*C. P. Radwan*

**The largest attendance in the history of the Fond du Lac chapter was on hand November 12 for ladies night and the twelfth anniversary meeting. The dinner program was held at Bernard Hall. David Laughlin, pictured here, was master of ceremonies. The group was welcomed by Chairman Erwin J. Kaiser. Entertainment was provided by "Sir Richard Drake," a professional television performer.—*R. M. Hanson***

# Long Island Records a Busy Month

Long Island—ASTE activities during the month of November kept members of the Long Island chapter on the go. The biggest meeting in terms of attendance was held on November 9 at Grumman Aircraft Engineering Corp. where 312 members and guests toured the plant, had dinner, and participated in a business and technical meeting.

The tour was arranged by John Barnes, program committee chairman. With the help of guides and tape recordings stationed at strategic points along the route, the many interesting phases of aircraft manufacture were described for the ASTE visitors.

After a roast-beef dinner served by the company, the chapter's nominating committee was selected. Members are William Rogers, George McDermott and Mrs. Sara T. Moxley. The technical talk on "New Arts in Precision Boring" was made by Charles DeVleig, president of DeVleig Machine Co., Detroit. Guests at the meeting included Carl Kertesz, member of the National Membership Committee, Eugene Roth, past chairman of the Greater New York chapter, and Stanley P. Cook, chairman of the Mid-Hudson chapter.

On November 23 a panel discussion on carbide tooling drew an attendance of 40 members. Panel members were: Frank Italiano, tool engineer, American Machine & Foundry Co.; Walter Jellig, chief tool engineer, Ford Instrument Co.; Martin Romanac, supervisor, Liberty Products Corp., William Thomas, cutting tool applications engineer, Fairchild Engine Div.; William Trowbridge, assistant foreman, Grumman Aircraft Engineering Corp.; and Douglas Hill, staff engineer, Grumman Aircraft Engineering Corp.

The chapter's student section met on November 3 to hear a talk by Harold Poett, optical tool engineer, Grumman Aircraft Engineering Corp. His subject was "Fundamentals of Optical Tooling." New officers of the section were installed. They are John Oliver, vice chairman, and Frederick Newman, secretary.

*—Sara T. Moxley*

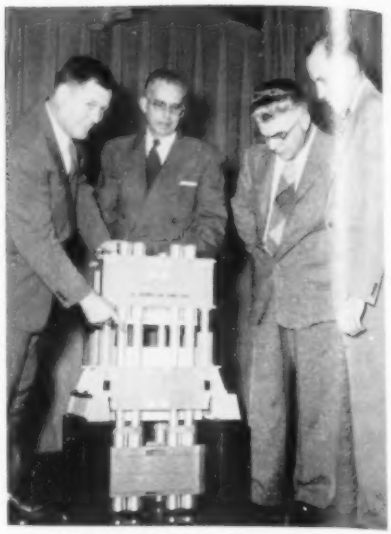
## Glen H. Stimson Talks at Springfield Meeting

Springfield, Ill.—More than 65 members and guests turned out for the November meeting of the Springfield chapter at The Mill. Glen H. Stimson, sales manager and chief engineer, Gage Division, The Greenfield Tap and Die Corp., Greenfield, Mass., addressed the group on "Facts about Taps and Tapping." He illustrated his talk with a color film and went into detail on the Unified Screw Thread.

*—Charles Collier*

## New Firm Established

Lima ASTE member Gus Gasdorf has recently established his own tool and die shop. The firm is known as the Gasdorf Tool and Machine Co. and is located at 342 E. North Street in Lima. Mr. Gasdorf was formerly assistant to the general manager of the Lima Division of Lennox Furnace Co.



**Principal speaker at Peoria's November 3 meeting was K. A. Landis, left, planning coordinator for the E. W. Bliss Co. He explained the problems in designing a 34,000 ton press. Shown with him are: Robert Kolb, technical chairman for the meeting, Vic Kuhns and Eliott Breese.**

*—Russ Saurs*

## Three Speakers Heard at Portland Meeting

Portland, Me.—Victor De Vinney, Harold Frost, Jr., process engineer, and Richard A. Steele, field service representative, all of Turco Products, Inc., spoke at the November 13 meeting of the Portland chapter at the Columbia Hotel. The session was devoted to their company's recently developed process for economically checking for scratches, cracks, and other surface imperfections.

*—Henry C. Hagman*

**An interesting stop on Long Island chapter's tour of Grumann Aircraft Engineering Corp.**

## Thomas J. Donovan Addresses 200 Members

North Hollywood, Calif.—More than 200 members and guests attended the November 4 meeting of San Fernando Valley chapter to hear Thomas J. Donovan, Jr., past national director of ASTE. Mr. Donovan discussed heat treating, stressing the care needed in selecting metals and the importance of the role assigned the heat treater.

A nominating committee was elected to put candidates on the slate for the coming elections, the committee to be headed by J. Parks, assisted by L. Biehler and A. D. Lewis.

At the October meeting it was announced that the total membership of the chapter had climbed to 326 after only 14 months of operation. In addition, Arthur D. Lewis, national delegate, awarded a Tool Engineers Handbook to Matthew M. Margulies, chairman of the education committee, for sponsoring the most new members during the past six months.

The technical program at this meeting consisted of a talk by Kenneth P. Martin, of Cincinnati Milling Machine Co., Cincinnati, on "The Hydroform, a New Kind of Machine Tool." W. J. Merbath, research engineer with Aerojet Engineering Corp., discussed jet and rocket propulsion and showed a movie on the Aero-Bee research rocket.

*—C. D. Colvey*

## Chief Engineer Discusses Developments in Gearing

Rockford—During the business session at Rockford's November meeting at the Lafayette Hotel, Karl Keyzer, George Torrence and Bruce Lundgren were elected to serve on the chapter's nominating committee.

The technical program featured a talk on significant developments in gearing by Walter P. Schmitter, chief engineer at the Falk Corp., Milwaukee. Slides illustrated his talk.

A coffee discussion on "Your Police Department" was presented by Rockford's chief of police, Thomas Boustead. The meeting drew an attendance of 150. *—Kenneth Hull*

## L. D. Fykse Joins Cleveland Hardware Co.

Herbert E. White, president of the Cleveland Hardware and Forging Co., Cleveland, O., has announced the appointment of Lewis D. Fykse as vice president in charge of sales of the company's forging, die casting, and truck and body hardware divisions.

**Indianapolis chapter's annual Executive's Night, held November 5 at the Sahara Grotto, drew more than 200 members and guests from industries in the Indianapolis area. Just before the program got underway, officers and speakers gather for a group photograph. From left: Lloyd Turner, treasurer; Prof. O. D. Lascoe, member of the National Education Committee; Tell Berna, general manager of the National Machine Tool Builders Association; Joe Penn, chapter chairman; H. C. McMillen, ASTE third vice president; Joe Enright, first vice chairman; Roy Erickson, program chairman; and Lloyd Refer, secretary.**

# Howard McMillen and Tell Berna Address ASTE Audience at Indianapolis Meeting

Indianapolis—Events featured at the Executives' Night meeting of the Indianapolis chapter included talks by Howard C. McMillen, third vice president of the Society, and Tell Berna, general manager of the National Machine Tool Builders Association. Mr. McMillen spoke on national activities of ASTE while Mr. Berna discussed "Engineering for the Future."

Also on the program were a number of songs by the men's chorus from the Allison Division of General Motors Corp.

On November 8 the Indiana Council of ASTE chapters held its third meeting. It was devoted to the plans and arrangements made under the direction of Prof. O. D. Lascoe for the Purdue University Tool Engineer conference to be held next May. Attending the session were: Mr. and Mrs. Don Welbaum, Mr. and Mrs. Harold Housewerth, Mr. and Mrs. Joe Penn, Mr. and Mrs. N. Berker, Mr. and Mrs. Joe Enright, Mr. and Mrs. Blaine Garard, and Mr. and Mrs. Loyd Turner.

Also present were: James Nelson, M. B. Rosenbarger, Lloyd Refer, Arthur Ullman, Ted Harding, Paul Veirling and James Kemp.

*—M. B. Rosenbarger*

**A radio broadcast from station WROK will be aired in January by members of the Rockford ASTE chapter. The program will include a panel of winners of the high school contest sponsored by the Rockford chapter, as well as industrial and chapter representatives. Making plans are: Oscar Olson, Rockford East High School instructor; Lester Teachout and Howard White, editorial and public relations committee; and Al Sabin, Rockford West High School instructor.**

## Roger Waindle Appoints ASTE Progress Committee

National President Roger F. Waindle has announced the appointment of seven members to the newly formed Progress Committee.

Serving with Mr. Waindle on this ASTE committee are: L. B. Bellamy, past president and a national director; Ray H. Morris, past president and parliamentarian; H. C. McMillen, third vice president and a national director; R. C. W. Peterson, national secretary; Wayne Ewing, assistant secretary-treasurer; Harry E. Conrad, executive secretary of the Society; and L. G. Singer, Toronto chapter member.

Established through action taken at the last meeting of the board of directors, the Progress Committee will appraise the current activities of the Society in light of present-day conditions, and will consider future activities aimed at providing the greatest possible service to ASTE members everywhere.

## Carbide Tools Analyzed at Los Alamos Meeting

Los Alamos—Malcolm F. Judkin, chief engineer, Firth-Sterling Co., McKeesport, Pa., was the guest speaker at the November 11 meeting of the Los Alamos chapter. The event took place at the "Little Theater," Los Alamos High School.

Mr. Judkin presented a program on the latest applications of carbide tools in industry which he illustrated with slides and a lively question period followed the talk. *—H. J. Von Steeg*

**Speaker W. H. Gourlie, left, is welcomed by Kenneth Blaisdell at the November meeting of the Springfield, Mass., chapter.**

## Nashville Discusses Grinding Machines

Nashville—Members and guests of the Nashville chapter gathered at the B & W Cafeteria for their regular monthly meeting on November 17. "Product Analysis and Equipment Selection for Grinding Machines" was the topic of a talk given by James Meehan, director grinding machine sales, Brown & Sharpe Mfg. Co., Providence, R. I. He told the assembled group how to select the right grinding machine to suit the individual job or shop.

Guests at the meeting were John Jehle, chief engineer, Yale & Towne Mfg. Co.; Harry Clipp, engineer from the same company; Ly Johnston, Jr., of Nash Tool and Stamping Co.; Douglas Martin, engineer with Aladdin Industries; and Robert Malone, foreman with Phillips Buttorff Mfg. Co.

*—J. E. Wilkinson*

## Trends in Gaging Covered by W. H. Gourlie

Springfield, Mass.—A program on "Today's Trend in Gaging" was presented for 130 Springfield members at the November meeting by W. H. Gourlie, sales engineer for the Sheffield Corp. and an active member of the Hartford ASTE chapter. A former member of the Unified Thread Commission, Mr. Gourlie participated in both national and international programs for gaging standardization, for the past 25 years. He was assisted by Robert Hartman, also a sales engineer with Sheffield.

Special guests at the meeting included two national representatives of ASTE, Richard Smith, national director, and Robert Gay, area captain for the National Membership Committee. They discussed recent news of the Society.

The chapter's plan of holding a supper club, instead of a regular dinner, was carried out again for this meeting. This policy has been credited with attracting more than four times the attendance drawn to the dinner meetings formerly held. *—George H. Foy, Jr.*

## North Texas Hears about New Types of Plastic

North Texas chapter met at the Amon Carter International Airport for its regular monthly meeting on November 13. Featured speaker of the evening was George C. Adams, staff engineer, Rezolin, Inc., Los Angeles. The subject of the talk was "Tooling in Plastics" and covered several new types of plastic. *—F. Paul Simpson*

**Upper left: Two buses loaded with 79 San Diego members traveled to Fontana, Calif., on October 24 for a tour through the Kaiser Steel Plant. The extensive visit took nearly four hours and was topped off with a dinner served in the company cafeteria. Upper right: Donald Crayton of Consolidated Vultu Co. was one of three optical tooling experts who presented the November program at San Diego. Other speakers were C. L. Alling, Rohr Aircraft Corp., and Ralph Hamilton, Farrand Optical Co. More than $15,000 worth of instruments were used in the accompanying demonstrations. Attendance totalled 112 members and guests.—*William J. Keller***

National President Roger F. Waindle, who is also a past chairman of the Fox River Valley chapter, was a special guest at the group's meeting honoring past chairmen held November 3 at the Baker Hotel in St. Charles. Pictured with him, back row, are: Gus Wallen, Herb Braun, Mr. Waindle, and Bert Phillips. Front row: George Parsons, Tom Kings, and George Bodi. —*Willard C. Perkins*

## Robert Wolff Named to ASTE Education Committee

Roger F. Waindle, national president of ASTE, and Arthur R. Diamond, chairman of the National Education Committee, have announced the appointment of Robert E. Wolff as a member of the National Education Committee.

Mr. Wolff, a member of the Chicago ASTE chapter, is assistant marketing manager of the Tool and Machine Division of the Illinois Tool Works.

Robert Wolff

A graduate of the Engineering School at Northwestern University, Mr. Wolff was formerly associated with Link Belt Corp. He has been active in the American Society of Mechanical Engineers, the Farm Equipment Institute, as well as the American Society of Tool Engineers. He has served as chairman of the master gear standardization committee and as secretary of the milling cutter division of the Metal-Cutting Tool Institute.

During World War II, Mr. Wolff was a member of the vocational advisory committee to the United States Office of Education in the preparation of a machine shop work series of visual training aids. While serving the National Production Authority in Washington, D.C., he conducted a special survey on broaches for the Metal Working Equipment Division.

## Annual Ladies' Night Held by Toledo Chapter

Toledo—The annual Ladies' Night dinner dance was held at Turner's Club on November 13 by the Toledo chapter. Approximately 55 couples attended. Entertainment was provided by the "Toledo Starlites" featured in a varied floor show. —*James F. Sullivan*

## Cleveland Chapter Holds Forum Discussion

Cleveland—A forum discussion on "Short Run Tooling" was held for ASTE members in Cleveland on November 13. Each panel member spoke for five minutes before the general discussion and later on answered questions from the floor.

Speakers and their topics were: John A. Harrington, chief engineer, DoAll Co., who spoke on short run dies; Paul F. Rossbach, chief tool designer, Eaton Mfg. Co., who talked on principles; L. W. Sahley, president of Euclid Tool Engineering Co., who covered short run jigs and fixtures; Jack Schron, vice president of Jergens Tool Specialty Co., who spoke on standardization; and L. K. Stringham, chief engineer with Lincoln Engineering Co., who talked on welding.

The coffee speaker for the program was Dr. Gisbert L. Bossard, director of the Fairchild Technical Institute, Inc. A total of 125 members and guests attended. —*R. C. Carmichael*

## DoAll Research Director Covers Friction Cutting

Warren, Pa.—Some 86 members and guests turned out for the regular monthly dinner meeting and technical session of Chautauqua-Warren chapter on November 19. It was held at the Marconi Outing Club.

Putting business before pleasure, the chapter selected by ballot the nominating committee which will serve in the coming elections. On the committee are Robert H. Alexander, Robert J. Pearson and Robert J. Wilson, Jr.

The technical session featured a talk by George H. Sheppard, director of research and training, DoAll Company, Des Plaines, Ill. With the help of slides and various illustrative charts, Mr. Sheppard discussed "Friction Cutting and High-Speed Sawing." He stressed that high-speed band sawing is not suitable in many applications.

Special guests were two DoAll representatives: Stuart F. Hull of Buffalo, and Lawrence H. Peirce of Erie and Buffalo, both salesmen in their respective territories. —*Laurence R. Green*

## University Citation Presented Grant Wilcox

Grant S. Wilcox, Jr., past national director of ASTE who was honored at the last meeting of the Society board of directors for his efforts in formulating the definition of tool engineering for Webster's Dictionary, has received special recognition from the University of Michigan. He was awarded a citation at the convocation for the university's Centennial of Engineering.

Mr. Wilcox is coordinator of special program development for Plymouth Division of Chrysler Corp.

## Automation Discussed at New Haven Meeting

New Haven—Members to serve on the nominating committee were elected at the November meeting of the New Haven chapter. They are John Alton, chairman, Al Pollard and Robert Burgess. The dinner session was held at the Hotel Garde. About 50 members and guests attended.

The technical program was presented by Julius Kaplan of Arma Corp., a division of American Bosch Co. He spoke on the subject "Automation."

Using slides to illustrate his talk, Mr. Kaplan described the various types of memory systems and sensing devices required to make machines and processes fully automatic and repetitive.

## Malcolm Judkins Gives Salt Lake City Program

Salt Lake City—"Manufacture and Use of Sintered Carbide" was the subject discussed by Malcolm F. Judkins when he addressed the Salt Lake City chapter at the November 13 meeting. Mr. Judkins is new products manager for Firth Sterling, Inc., Pittsburgh.

He emphasized the need for a maximum of sturdy, strong support in the shank for every carbide cutting tool. "Use of carbide cutting tools is a science, not a hit-or-miss affair," he said.

Another guest at the meeting was Lloyd W. Mead, assistant manager of the Pacific Coast Division.

*—Reid L. Rice*

## Titanium Talk Topic at Baltimore Meeting

Baltimore—A film called "Highlights of Farnborough 1952," revealing progress in aircraft design in England, was shown at the November 4 meeting of the Baltimore chapter.

The technical speaker was Frank H. Vandenburgh, vice president and general manager of the Mallory-Sharon Titanium Corp., Niles, Ohio. His subject was "Machining, Welding and Fabrication of Titanium."

*—C. G. Kelley*

## Erie Records Annual Ladies' Night

Erie—East Erie Turner's Ballroom was the scene of Erie's Annual Ladies' Night program November 7. Dinner, corsages, ballroom and square dancing rounded out an entertaining evening. Entertainment was under the supervision of Mr. and Mrs. Robb.

*—H. W. Sedler*

With this distinctive and unusual license plate on his car, Austin G. Cragg is easily spotted as he covers his territory as eastern advertising manager for THE TOOL ENGINEER magazine. Believed to be the only official state plate of its kind, the license was issued by the state of Connecticut where Mr. Cragg resides.

It has been the policy in Connecticut to issue license plates, upon request, with letters rather than numerals to selected drivers. Mr. Cragg considers himself fortunate to have obtained the ASTE combination and reports many favorable comments from members and others who recognized the significance of the identification.

## IBM Representative Speaks to Little Rhody

Little Rhody's November dinner meeting featured a talk by N. K. Perkins of International Business Machines Corp., Poughkeepsie, N. Y. In his talk on "Small Parts Design and Manufacture," Mr. Perkins described and exhibited tiny gears used in American watchmaking. Approximately 85 attended.

An announcement was made at this meeting of a free tool engineering course offered by the Providence Trade School under state and federal sponsorship.

*—Maurice A. Shoos*

## Niagara Chapter Greet 21 New ASTE Membe

St. Catherines, Ont.—The high ight of the Niagara District chapter's N em- ber 5 meeting at Queensway Hote was the introduction of 21 new membe

Technical speaker, Mr. H. V ctor Harding, Elox Corp., Clawson, M ich., addressed the group on "Electrical Discharge Machinery." The process h de- scribed saved a great deal of m ney during the last war by removing br ken taps, reamers, and drills from co po- nents that otherwise would have been considered scrap. *—William A. Yaeger*

## ASTE Officer Addresses Piedmont Executives

Greensboro, N. C.—Nearly 90 members and guests of the Piedmont chapter met at the King Cotton Hotel for Executives' Night on November 9. ASTE's third vice president, Howard C. McMillen, addressed the group on the objectives and future plans of the Society.

A talk on "Operation Tinkertoy" was given by C. W. Reynolds of Western Electric Co., Inc. He described the Navy's experimental atomic factory for producing electronic components.

**Principal speakers at the annual Executives Night held by the Piedmont chapter were, from left: C. W. Reynolds, E. N. Dietler, W. H. Neal, and Howard C. McMillen, third vice president of the Society.**

The future of industrial growth of North Carolina was discussed by W. H. Neal, senior vice president of Wachovia Bank & Trust Co. He said that in making technological progress, we must not overlook sociological progress. Describing the industrial development now in progress in North Carolina, Mr. Neal urged the establishment of more vocational education programs to keep pace with this expansion.

*—Henry H. Palmer.*

**A program on "Magnetic Chucking" was given by representatives of the Sundstrand Machine Tool Co. at a recent meeting of the Wichita ASTE chapter. From left: R. O. White, ASTE first vice chairman; A. A. Reddy, chapter chairman; Glenn H. Pearson, sales engineer, and Frank Suchanek, sales manager of Sundstrand Magnetic Products; and F. Earl Baker, program chairman.**

**Main speaker at Evansville's November meeting was John R. Harbaugh, center, head of the metallurgical department at Jessop Steel Co., who spoke on tool steel failures. Pictured with him, from left, are: Monroe Ringis, program chairman for the meeting; Oliver Blair, assistant to the president of Jessop Steel; Charles Walker, Jr., chapter program chairman; and R. R. Huffman, district manager of sales for Jessop.**—*Guenther F. Wulf*

## Positions Wanted

SALES REPRESENTATIVE — with 15 years experience in automotive and aircraft companies desires position in Detroit area. Experience includes aircraft tools of all types, precision and assembly tools. Have also handled all phases of tool designing, product designing, processing and manufacture in this field. In the automotive field, my experience has been tool designing, dies, estimating, machine parts, and stampings. For complete resume write to Box 090, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

IF YOU ARE ABLE—to use, on a permanent basis, a man with 20 years experience in Mechanical Research Design, Processing, Application and Sales Engineering. Write for complete resume to "Mechanical Engineer," 1225 Atlantic St. NE, Warren, Ohio.

MANUFACTURER'S REPRESENTATIVE—wants additional companies to represent such as Tool & Die Co., Special Machinery, Casting, or Mechanical Lines. Headquarters in Buffalo, N. Y. Please write Box 080, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

MANUFACTURER'S REPRESENTATIVE—with established engineering office in Los Angeles. Good contacts in aircraft and other manufacturing plants. Over twenty five years experience in Tool Engineering, production methods and special production machines. Wants to become manufacturer's representative for both sales and engineering service for Los Angeles area or the whole state. Write to: Box 070, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

## Vice President Visits Central Pennsylvania

Waynesboro, Pa. — Members and guests of the Central Pennsylvania chapter visited the Landis Tool Co. in Waynesboro, Pa. in November. Among points of interest on the conducted tour were the engineering and standards departments.

The 70 ASTE members and guests were then guests of the Waynesboro Country Club where Howard C. McMillen, third vice president of ASTE, addressed the members on National activities of ASTE.

Joseph Steiner, plant manager with the Landis Tool Co., described the machine tool show held in Western Germany recently, elaborating on new and modern machinery and machine tool plants which have been erected in Western Germany since the war.

—*Paul F. Leese*

## Binghamton Elects Nominating Committee

Vestal, N. Y.—Binghamton chapter held its regular monthly meeting at the American Legion Clubhouse. After a brief business session, 75 members present elected a nominating committee for election of 1954 officers.

The nominating committee will consist of William Liendecker, chairman of the group, and Roger E. Coles and George Conine. All of them are past chairmen of the chapter.

A. L. Coleman, of Endicott Forging Co., then presented the colored film, "Impression Die Forging," which went into detail on forging procedure.

—*Charles L. King*

## Philadelphia Visits Yale & Towne Plant

Philadelphia—At the first tour of its type conducted by the Philadelphia chapter for several years, 120 members visited the Red Lion Road plant of Yale & Towne Mfg. Co. at their November 9 meeting. Arrangements for the visit were made by Edward Rauss, chairman of the carbide committee.

The plant is a modern one-story structure with a floor area of 775,000 square feet. More than 3,000 persons are employed in the manufacture of industrial power trucks, hand and motorized lift trucks and hand and electric hoists.

ASTE members were impressed by the immensity of the plant which began operations at the new site in 1949. Many noteworthy examples of ingenious tooling and processing were observed. Good housekeeping was evident everywhere.

At the chapter's November 19 meeting, E. Von Hambach spoke on "Tips on Machining Stainless Steels." He is research and development engineer for Carpenter Steel Co.

Before the featured talk was delivered, a nominating committee was named to recommend a slate of candidates for the chapter election coming up. Serving are Frank DeFrates, Michael Lapinski, and Sid Matthews.

—*Jack Schroth*

## Taps and Tapping Topic of Massachusetts Talk

Gardner, Mass.—Northern Massachusetts chapter held its November meeting at the Colonial Hotel and some 160 members and guests were on the scene.

Glen H. Stimson, sales manager and chief engineer, Greenfield Tap and Die Corp., Greenfield, Mass., addressed the group on the topic "Facts about Taps and Tapping." Mr. Stimson outlined the history and development of the Unified Thread Screw in his talk and showed a movie to illustrate his presentation.

—*Leslie H. Laughton*

## Optical Gaging Discussed at Pittsburgh Session

Pittsburgh—E. C. Polidar of Optical Gaging Products Co. was the featured speaker at the November meeting of the Pittsburgh chapter. The joint session with the Westinghouse unit was held at the Sheraton Hotel. Eighty members and guests attended. A general discussion period followed the speech on optical gaging and its applications.

—*E. L. Caughey*

## Sintered Tools and Dies Topic at Albuquerque

Albuquerque—At the November 10 meeting of the Albuquerque chapter, members elected their nominating committee who will serve for the coming election. Chosen as chairman was Arthur Miller. Serving with him will be H. R. Hanen and Robert Tarbell.

Speaker on the evening's program was Malcolm F. Judkins, manager, New Products Division, Firth-Sterling, Inc., Pittsburgh. In addressing the group on "Applications of Sintered Tools and Dies," he described the advantages of carbide-tipped cutting tools for heavy alloys and stressed the importance of using correct rake angles and proper carbide formulation for particular alloys.

"Among the most obvious qualities of the sintered carbides," he said, "are high compressive strength, extreme hardness, and long life."

*—H. E. Anderson*

## Saginaw Valley Chapter Tours GMC Division

Saginaw, Mich.—A large turnout of 230 members and guests was present for Saginaw Valley chapter's tour of the Saginaw Steering Gear Division of General Motors Corp. The well-organized visitation followed dinner and a talk by Clovis W. Lincoln, chief engineer at the plant.

Mr. Lincoln discussed "Power Steering" and used slides showing various details of GMC's power steering device.

*—Kent B. Arnold*

**John Harrington, left, chief engineer for the DoAll Co., receives a barometer from Rochester Chairman Don Kohler after delivering his talk on wheel dressing and surface grinding.**

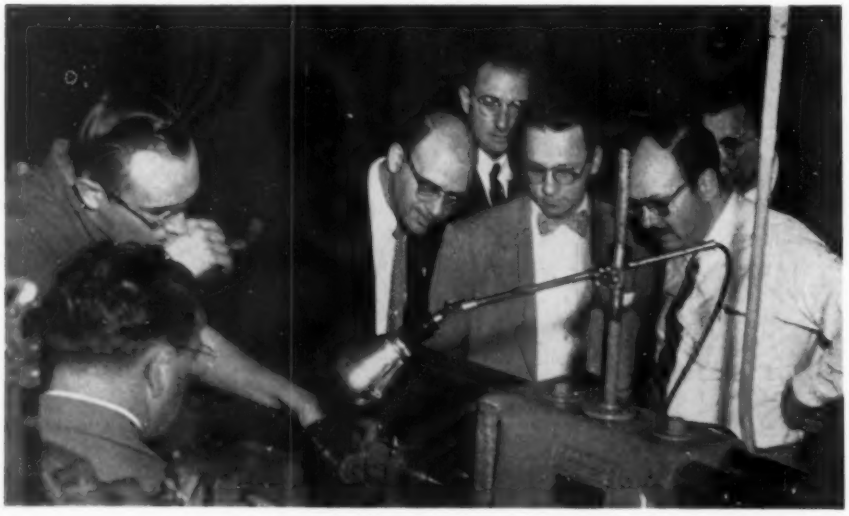
## Cincinnati Program Features J. L. Karash

Cincinnati—Joseph L. Karash was the technical speaker at the November meeting of the Cincinnati chapter. Process engineer for Reliance Electric and Engineering Co., Cleveland, Mr. Karash discussed "Principles of Locating."

Covering three types of locating—plane, cylindrical, and radial—he emphasized the basic principles involved in accurately positioning workpieces in various types of jigs and fixtures. With the use of slides, he pointed out methods of accurately locating workpieces without making insertion or removal difficult.

After dinner, served at the Engineering Society of Cincinnati, members saw a movie produced for the Champion Paper Co., Hamilton, Ohio, and later welcomed 13 new members.

*—Louis H. Schumann*



**This group of tool engineers shows just a few of the 85 Racine ASTE members who toured the Illinois Tool Works in Chicago at their November 2 meeting. The company, manufacturers of metal cutting tools, was also host to the chapter for dinner and a discussion period which followed the plant visitation.**

***—Charles P. Nelson***

## Lehigh Valley Tours Bethlehem Steel

Bethlehem, Pa.—A record crowd of 198 Lehigh Valley chapter members and guests toured the Tool Steel Division of the Bethlehem Steel Co., Bethlehem, Pa., on November 20.

They saw tool steel in the making, step by step—from the electric furnaces where the ore and other materials are smelted, through treatment where steels are classified, rolling where the steel is made into various shapes and sizes, to the final stage, the mill supply depot where large stocks of each type are stored.

Members found the most outstanding characteristic of the whole procedure was quality control. Tests and temperature checks are made throughout the entire process.

Following the tour, a 30-minute motion picture, "Making of Alloy Steel," was shown and the group adjourned to the Sarco Club in Fountain Hill, for a social hour.

*—George W. Savitz*

## K. P. Martin Heard on Dayton Program

Dayton—K. P. Martin, on another lap of his ASTE speaking tour, provided the November program for 75 members of the Dayton chapter. The well-traveled expert on the "Hydroform" machines represents the general machinery division of the Cincinnati Milling Machine Co. He was introduced by Program Chairman Roy Dusseau.

Chapter Chairman R. A. Miller opened the meeting by appointing members to serve on the nominating committee. The dinner and technical session were held in the Aviation Room of the Miami Hotel.

*—W. J. Killinger*

## A. J. Snyder Joins Motch & Merryweather

Clare R. Kubik, vice president for administration for The Motch & Merryweather Machinery Co., has announced the recent appointment of A. J. Snyder as sales manager of their Cutting Tool Sales Division.

Mr. Snyder, a veteran in the metal-cutting tool industry, was formerly vice president and general manager of the Morse Twist Drill and Machine Co., New Bedford, Mass. He recently served the government in the capacity of chief of the Cutting Tool Section, Metal-working Equipment Division of the NPA.

## Discusses Replacement of Tools and Machines

Hamilton, Ont.—At the business session which preceded the November technical program, Hamilton District ASTE members elected the chapter's nominating committee. Those named to office were George Churchill, William Alexander and Howard Boucher.

The program speaker, introduced by Joseph Sheldon, was Walter G. Hubbard, vice president of the Modern Tool Works, Toronto. He spoke on "Economics of Machine and Tool Replacement."

Mr. Hubbard stressed the fact that while the MAPI formula of machine tool replacement is not a cure-all, it offers many advantages over the commonly used methods of determining when a machine tool should be replaced. The MAPI formula, it was explained, not only gives a factual annual dollar amount of gain which can be expected when a machine is replaced, but also gives the cost of *not* replacing the machine.

A couple of examples were given showing the very substantial gains made by a company when it took advantage of the high productive capacities of some of the equipment introduced to the market over the past few years.

On November 5 Hamilton members and their guests enjoyed the annual autumn dance held at the Brant Inn in Burlington. Eighty-four couples attended. —*John Litwin*

## Harry Conn Covers Tooling Problems

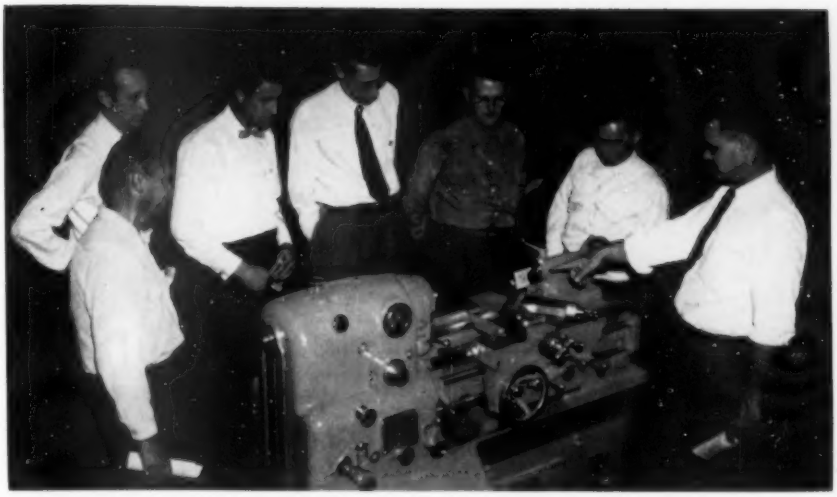
Hartford—"Production Tooling Problems" were discussed November 2 at a meeting of the Hartford ASTE chapter. Speaker was Harry Conn, chief engineer of Scully-Jones and Co., Chicago, and an active committee chairman of the Chicago ASTE chapter.

In his well-rounded discussion, Mr. Conn pointed out that the use of standard tools is apt to limit the efficiency of machine tools.

The coffee talk at the dinner meeting was given by Sidney A. Edwards, managing director of the Connecticut Development Commission. He spoke on "What Connecticut Has to Offer."

According to chapter officers at New Haven, there is a pressing need for the services of a chapter member to act as official photographer in covering meetings and various programs for THE TOOL ENGINEER magazine and other chapter news channels.

—*A. Douglas Proctor*



**A group of Lima ASTE members inspects a Monarch lathe during a recent tour of the Monarch Machine Tool Co. From left: Paul Goodwine, Alex Daniels, Richard Shaw, Burton Schwertfager, Reece Stanley, Cyril Sterrett and Ed Martz.**

## Lima Provides Copies of Handbook and *The Tool Engineer* for Local Institutions

Lima—"Quality Castings—The key to Greater Production" was the title of the film program and technical talk made at the November 19 meeting of the Lima chapter. Speaker was C. E. Herrington, manager of sales engineering and development of the Meehanite Metal Corp., New Rochelle, N. Y. Mr. Herrington discussed the control of cast iron to obtain finer grain structure, how to flame harden it, its uses and structural advantages.

New members introduced by John Rentz, chairman of the membership committee, are: K. L. Wheelock, Robert Miller and Daniel McNeil.

On November 11 more than 200 members and guests toured the Ohio Steel Foundry Co. They inspected equipment and processes used in the production of iron and high-grade steel alloy castings. They also studied the finishing facilities of steel mill rolls, refinery fittings, valves and return bends, Fahrite heat resistant and specialty castings.

The chapter, through its education committee chairman, Barney Bishop, is sponsoring copies of the *Tool Engineers Handbook* and THE TOOL ENGINEER magazine for several institutions. Recipients are the Lima Public Library, Lima Vocational High School and Ohio Northern University at Ada, Ohio. The Lima library has also asked the chapter to recommend a selection of technical books on tool engineering.

—*Donald Cox*

## New Process Revealed at South Bend Meeting

South Bend—Some 83 members and guests of the South Bend chapter convened at Alby's Steak House on November 17. The technical session was devoted to a talk by H. V. Harding, technical assistant to the president, Elox Corp., Clawson, Mich.

Mr. Harding's talk, "Electro Spark Machining," revealed a process which will cut any known metal to precise dimensions and fine finishes with a tool which never touches the work and is done by a fully automatic electrical discharge method. —*Matthew J. Nowak*

## Anniversary Meeting Ends First Year

Scranton, Pa.—Keystone chapter's first anniversary was celebrated on October 1 at a dinner meeting held at the Hotel Casey. Invitations were sent to many of the industrial executives in the area. A large attendance was recorded.

Featured speaker for the program was John L. Schwab. He chose the topic "The Next Ten Years for the Tool Engineer."

Keystone members now have their own newsletter. Edited by Joe Rappengluck, the publication goes out with the monthly meeting notices and covers all of the interesting local news pertaining to the chapter and its members.

# *Coming* MEETINGS

CEDAR RAPIDS—Jan. 20. "How Tool Engineering Methods and Time Study Are Coordinated in Modern Industry" by J. L. Kilraly of A. T. Kearney Co., Consulting Engineers of Chicago.

CHICAGO—Jan. 4, 6:30 p.m., Keyman's Club. "Machine Tool Design" by Otto C. Turchan, director of research, Turchan Follower Machine Co., Detroit, Mich., and Robert S. Hahn, Heald Machine Co., Worcester, Mass.

CINCINNATI—Jan. 12, 8:00 p.m., Headquarters Engineering Society of Cincinnati. "Dynatomics, a New Concept in Metal Removal" by Kenneth R. Blake, president, Metalloid Corp., Huntington, Ind.

CLEVELAND—Jan. 8. "Modern Fasteners and Their Relation to Tooling" by L. J. Flora, director of engineering, and William Buttriss, advertising director, Tinnerman Products Inc., Cleveland, Ohio.

DETROIT—Student Section. Jan. 21, 7:00 p.m., Horace Rackham Bldg., "File Making" by Mr. Hayes of the Hayes File Mfg. Co.

EVANSVILLE—Jan. 11, 7:30 p.m., Hadi Shrine. "Expedition to the North Pole with Admiral Richard Byrd" by Joseph Begley, M. D.

FAIRFIELD COUNTY—Jan. 6. "Hydraulics as Applied to Industrial Machining" by representatives of Vickers, Inc., Detroit, Mich.

FORT WAYNE—Jan. 13, 6:45 p.m., Chamber of Commerce. "Automotive Broaching" by Joseph P. Crosby, vice president, Lapointe Machine Tool Co., Hudson, Mass.

FOX RIVER VALLEY—Jan. 5, 7:00 p.m., Baker Hotel, St. Charles, Ill. Melvin Verson and E. J. O'Connell from Verson Allsteel Press Co., Chicago, Ill., speaking on various types of presses.

GRAND RIVER VALLEY—Jan. 8. Radioactive Isotopes in Industry."

GREATER LANCASTER—Jan. 12, 6:45 p.m., Arcadia Cafe, Lancaster. "Multislide Presses" by A. Melnick, chief tool engineer, U. S. Tool Co., Inc., Ampere (East Orange), N. J.

LEHIGH VALLEY—Jan. 15, "Powdered Metal and Titanium" by Malcolm F. Judkins, manager, Firth Sterling Inc., New Products Division.

LIMA—Jan. 21, 6:30 p.m., Royal Pine Room. "Latest Developments in the Turning Field" by S. A. Brandenburg, vice president of sales, Monarch Machine Tool Co., Sidney, Ohio.

LITTLE RHODY—Jan. 7, 7:00 p.m., Johnson's Grille, Providence. "Cutting Tools" by Dr. W. R. Frazer, chief metallurgist, Union Twist Drill Co., Athol, Mass.

LONG ISLAND—Jan. 11, 8:30 p.m. Garden City Hotel, Garden City, L. I., N. Y. "Alkali Cleaning as It Pertains to Industry" by Wilford H. Ross, Jr., Detrex Corp., Detroit, Mich. Jan. 25, 8:00 p.m., Industrial Bldg., Long Island Agricultural and Industrial Institute. Panel discussion on blanking (by reservation only).

LOUISVILLE—Jan. 12, 6:45 p.m., YMCA at Third and Central. "Pivot Punches Their Uses and Application" by J. R. Reinertson, manager midwestern division, Pivot Punch and Die Corp., Chicago, Ill.

MID-HUDSON—Jan. 12. "Ordnance Materiel—Conception to Battlefield" by Col. T. D. Billingley, professor of ordnance, West Point.

MILWAUKEE—Jan. 16, 6:30 p.m., Milwaukee Elks Club. Annual scholarship fund dinner dance.

NASHVILLE—Jan. 19. "The Story of Steel" by R. N. McGee, special sales representative, Jones & Laughlin Steel Corp., Pittsburgh.

NEW HAVEN—Jan. 14, Hotel Garde. "Cutting Oils, Coolants and Waxes."

NORTHERN MASSACHUSETTS—Jan. 19. "The Cutting and Grinding of Titanium Alloys" by Prof. Milton C. Shaw, department of engineering, Massachusetts Institute of Technology.

NORTH TEXAS—Jan. 8, 6:45 p.m., Amon Carter International Airport. "Multipress Forming and Blanking" by R. H. Krepps, general manager, Denison Engineering Co., Columbus, Ohio.

PHILADELPHIA—Jan. 21, 6:30 p.m., Engineers Club. "Manual Activity as Related to Tool and Machine Activity" by V. Donald Schoeller, professor, University of Pennsylvania.

**Different phases of the topic "New Developments in Cutting Tools" were covered by these three speakers who addressed Chicago's November meeting. From left: D. D. McCurdy, Chicago Screw Co.; J. S. Gillespie, Carboloy Co.; and Matt Aljanich, Caterpillar Tractor Co.** ***—R. C. Berliner***

PITTSBURGH—Jan. 8, 6:30 p.m., Sheraton Hotel. "Threading" by G. M. Stickell of Landis Machine Co., Waynesboro, Pa.

ROCKFORD—Jan. 21, 8:00 p.m., Woodward Governor Co. Past Chairmen's Night. Program will be "G. E. House of Magic."

SAGINAW VALLEY—Jan. 21, 7:00 p.m., Zehnder's Hotel, Frankenmuth, Mich. "Precision Chucking and Gaging" by Ernest Holworth, co-owner, N. A. Woodworth Co., Birmingham, Mich.

SOUTH BEND—Jan. 16, 6:45 p.m., Hotel Oliver. Ladies' Night. Entertainment speaker, Edward McFaul on "How's Your Sense of Humor?"

SPRINGFIELD, ILL.—Jan. 5. "Static and Dynamic Balancing" by Werner L. Senger, Gisholt Machine Co., Madison, Wis.

SPRINGFIELD, MASS.—Jan. 11. "Hydroforming."

SYRACUSE—Jan. 12, 6:30 p.m., Onondaga Hotel. "Grinding of Cylindrical Parts Requiring Extreme Accuracy" by James Meehan, sales director, grinding machines, Brown & Sharpe Mfg. Co., Providence, R.I.

TORONTO—Jan. 6, 8:00 p.m. Plant tour of A. C. Wickman (Canada) Ltd., Toronto.

TWIN CITIES—Jan. 6, 5:30 p.m., The Covered Wagon. "Skyhook Balloons" and movies of same by J. R. Smith and Dave Church, mechanical division, General Mills, Minneapolis, Minn.

TWIN STATES—Jan. 13, Trade Winds Cafe, Springfield, Vt. "Atomic Energy for the Layman" by C. V. Moore, engineer, General Electric Co., Knolls Atomic Power Laboratory, Schenectady, N. Y.

## Atomic Energy Topic for Mid-Hudson Program

Poughkeepsie, N. Y.—"Atomic Energy for the Layman" was the topic of an address given for 130 members and guests of the Mid-Hudson chapter at the November meeting. Speaker was Charles Victor Moore, design engineer for Knolls Atomic Power Laboratory, General Electric Co., Schenectady, N. Y.

Reviewing a few principles of physics, Mr. Moore told where nuclear or atomic energy comes from and how it could be released in a controlled manner for the ultimate benefit of all.

During the business session preceding the program, members were elected to serve on the nominating committee. They are John L. Petz, Walter A. Stadtler and Stanley P. Cook.

A special guest at the meeting, Richard A. Smith, national director of ASTE, gave a few brief remarks and reported on the Society's semiannual meeting of the board of directors.

*—Harold J. DePew*

**Greater New York chapter's chairman, Hartley W. Barclay, left, congratulates John D. Dale, president of Charles Hardy, Inc., after his talk on the significance of powder metallurgy in mass production and national defense. The program was attended by 100 ASTE members and guests.**

***—Robert Frechman***

## J. A. Warren Addresses Peterborough Chapter

Peterborough, Ont.—Peterborough chapter met at the Empress Hotel on November 5 for its regular monthly meeting. Chief speaker was J. A. Warren, sales technician and engineer, Cincinnati Shaper Co., Cincinnati. Illustrating his talk with slides, Mr. Warren discussed "Modern Applications of Sheet Metal Machinery." He highlighted applications of the Cincinnati Press Brake Equipment.

*—E. H. Mason*

**Richmond, Ind., was the destination of 75 Fort Wayne members who traveled by bus on November 20 for a plant tour of the National Automatic Tool Co. A few who made the trip were, from left: Blaine I. Garard, Paul Peterink, Charles A. Haugk, Eugene J. Gildea, Jr., Donald D. Welbaum, Harry Hartman, and J. A. Deck, chairman of the plant tour.**


### Positions Available

TOOL AND MACHINE DESIGNERS—

One of Cincinnati's largest permanent design firms has openings in their own office for experienced machine, product and tool designers, and detailers.

Recent engineering graduates or students will also be given consideration. These are permanent positions with a substantial, stable leader in the field. We can offer top starting wages, modern working conditions, paid holidays, vacations, and other benefits. Our policies assure varied experience and unusual opportunities with a future.

New employees would be expected to settle on a permanent basis in Cincinnati. Please send resume to Cincinnati Designing, Inc., 8120 Blue Ash Ave., Cincinnati 36, Ohio.


## Annual Party Held by San Gabriel Valley

San Gabriel Valley chapter members, wives and guests held their annual autumn dance at the Rainbow Angling Club on November 6. Some 150 were there for the festivities. Entertainment was provided by the Montoya Sisters who performed Mexican folk dances.

Special guest was Thomas J. Donovan, Jr., past national director of ASTE. Also on hand were Wayne Ewing, national assistant secretary-treasurer; Ben J. Hazewinkel, a past national director; Rudolf Regen, chairman of the San Fernando Valley chapter; and Ralph Chrissie, past chairman of the Los Angeles chapter.

*—Peter Carter*

## Fort Wayne Chapter Hears K. P. Martin

Fort Wayne—Another of many ASTE programs presented this year by K. P. Martin, director of Hydroform activities, Cincinnati Milling & Grinding Machine Co., was heard on November 11 by 60 members of the Fort Wayne chapter. Mr. Martin gave the background of the Hydroform process and displayed a wide variety of parts used on his company's machines.

Coffee speaker at the dinner meeting was Col. Chester Lichtenberg, civil defense director for Fort Wayne.

*—Richard Spaw*

## Zagar Tool Co. President Gives Technical Address

Boston—The November meeting of the Boston chapter included a talk by ASTE's first vice president, Joseph P. Crosby, and a technical program given by the president of the Zagar Tool Co., Inc., Frank Zagar.

Mr. Crosby reported on action taken at the last meeting of the Society's board of directors and also discussed the proposed charter for student chapters of ASTE.

Mr. Zagar gave a talk on multiple spindle drilling operations, pointing out the high production and accuracy that can be maintained through the use of this method.

A film, loaned by the National Tool and Die Manufacturers Association, was shown to the chapter and illustrated the importance of the small independently owned tool and die shops tc the larger industries. *—Harry Midgley*

## Speaker Advises Use of Tool Engineers Handbook

Rochester—Use of the *Tool Engineers Handbook* as a reference for grinding problems was advised by John Harrington of the DoAll Co. in his address before 80 members of the Rochester chapter. He also stressed the importance of selecting the proper grade of diamond for dressing wheels and the proper balancing of the wheels on the spindle, pointing out that finishes acceptable eight years ago are not acceptable today.

During the business session of the program, held at Barnard's Exempt Club, the chapter's annual nominating committee was selected. Serving are James Horne, Charles DeMartin and Norman Fowler. —*P. Bruno*

**Albert W. Agnew, standing, application engineer at Vickers, Inc., was the program speaker at the November meeting of the Long Beach chapter. His talk on hydraulic systems and circuits was heard by 80 members at the Lafayette Hotel. Seated at the speakers' table are: Carlyle E. Blanchard, chairman; Carroll B. Edson, first vice chairman; LeRoy Hutchinson, treasurer; Anson Browne, historian; and Larry Pomerantz, secretary.** —*J. J. Smith*

**These speakers were featured at the November 17 meeting of the Santa Clara Valley chapter. S. A. Brandenburg, left, vice president in charge of sales, Monarch Machine Tool Co., spoke on developments in the turning field. Dr. L. H. Cook, right, described his recent tour of Europe and visit to the Brussels Machine Tool Show.**
—*Glenn Herreman*

## Detroit Presents Life Memberships

Detroit—Eleven of the men who originally signed the charter for the incorporation of the American Society of Tool Engineers, were awarded Life Membership Certificates by the Detroit chapter on November 12.

Michigan's governor, G. Mennen Williams, gave an address on the importance of the tool engineer in the future growth of industry of Michigan.

Executive Secretary Harry E. Conrad and Mrs. Conrad were the guests of Michael Pinto, chairman of the Detroit chapter.

Recipients of the awards were Cecil C. Buckner, Edward R. DeLuiz, Ray H. Farmer, William J. Fors, Fred L. Hoffman, Alfred H. Hoffman, Casper S. Horn, Walter L. Newton, Edward A. Rutt, Frank H. Hartlep and Harold T. Johnson.

## Denver ASTE Program Features Chief Engineer

Denver—Fifty members of Denver chapter met at Cunningham's Restaurant on November 12 for their regular monthly meeting. Malcolm F. Judkin, chief engineer, Firth-Sterling, Inc., Pittsburgh, was the technical speaker. He chose as his topic "Applications of Sintered Carbide Tools and Dies."
—*James M. Johnson*

## New Orleans Speakers Review Basic Hydraulics

New Orleans—The subject of basic hydraulics was covered November 11 at a meeting of the New Orleans ASTE chapter. Speakers were Paul F. Oswald of the Edwards Engineering Corp. and Arthur G. Hulstrand of the Chrysler Corp.

Mr. Hulstrand traced the historical background of hydraulics and explained the different types of pumps, motors, valves and circuits. In his discussion Mr. Oswald explained diagrams of circuits using the different JIC symbols.

## Hugh Taft Discusses High Speed Spindles

The November meeting of Keene Co-Chapter, Twin States affiliate, had an attendance of 63. The group met at Kingsbury Tool Corporation to hear a talk by Hugh Taft, engineer, Bryant Chucking Grinder Co., Springfield, Vt.

In his talk, "High-Speed Spindles," Mr. Taft traced the history of high-speed spindles through all bearings to the latest air bearing spindles.
—*D. J. Brown*

## Paul Taylor Speaks at Two Wichita Meetings

Wichita—Members of Wichita chapter's nominating committee were named at the November 11 meeting held at Wolf's Cafeteria. Serving this year are Chapter Chairman A. A. Reddy and Past Chairman Harold Bales and Orville Strahm.

The technical address was given by Paul H. Taylor, director of the Hydra Spring Divison of Wales Strippit Corp., North Tonawanda, N. Y. The program was repeated the following evening for the chapter's student section which met at the University of Wichita.
—*John G. Temple*

## Elmira Hears About TV Tube Production

Elmira, N. Y.—The regular monthly meeting of the Elmira chapter was held at the Mark Twain Hotel on November 2. Approximately 85 were on hand to elect the nominating committee for the coming election of officers.

During the technical session which followed, Harry F. Pully, superintendent of cathode ray tube manufacturing, Electronic Tube Division, Westinghouse, Elmira, N. Y., explained the production of black and white, and color TV tubes.
—*J. D. Graham*

## Milwaukee Meeting Devoted to Baseball

Milwaukee—The Allen-Bradley Co. was host to the Milwaukee ASTE chapter on November 12 for a program devoted to the Milwaukee Braves baseball team. Nearly 200 members and guests were present. —*Walter Behrend*

# Directory of ASTE Chapter Chairmen and Meeting Nights

**AKRON**, Third Tuesday, F. A. Finnery, 211 Edgerton Rd., Akron, Ohio

**ALBUQUERQUE**, First Friday, H. P. Baecker, 1721 Ridgecrest Dr., Albuquerque, N.M.

**ATLANTA**, Third Monday, C. D. Sisley, Jr., 774 Dill Ave., S.W., Atlanta, Ga.

**BALTIMORE**, First Wednesday, D. E. Wernz, 1214 Regester Ave., Baltimore 12, Md.

**BINGHAMTON**, First Wednesday, H. D. Bertholf, 46 Matthews St., Binghamton, N.Y.

**BOSTON**, Second Thursday, W. B. Wells, 94 Walnut Hill Rd., Chestnut Hill 67, Mass.

**BUFFALO-NIAGARA**, Second Thursday, W. J. Iekel, R.F.D. 1, Springville, N.Y.

**CANTON**, Fourth Tuesday, C. H. Smith, 602 9th St., N.W., Canton, Ohio

**CEDAR RAPIDS**, Third Wednesday, R. L. Coyner, 119 Rapids Ave., S. W., Cedar Rapids, Iowa

**CENTRAL PENNSYLVANIA**, First Wednesday, R. H. Meckley, R.F.D. 1, Red Lion, Pa.

**CHAUTAUQUA-WARREN**, Third Thursday, R. J. Wilson, Jr., Sylvania Prod. Co., Warren, Pa.

**CHICAGO**, First Monday, H. A. Paine, Federal Machine Sales, 4639 Washington Blvd., Chicago 44, Ill.

**CINCINNATI**, Second Tuesday, R. B. Niebusch, 3921 Woodford Rd., Cincinnati 13, Ohio

**CLEVELAND**, Second Friday, G. W. Carlton, 1910 Seneca Dr., Euclid 17, Ohio

**COLUMBUS**, Second Wednesday, E. A. Bartlow, 2080 Riverside Dr., Columbus 12, Ohio

**DAYTON**, Second Monday, R. A. Miller, Economy Tool & Die, P.O. Box 127, Dayton 10, Ohio

**DECATUR**, Next to last Thursday, Robert Serr, Forrest Knolls Est., Decatur, Ill.

**DENVER**, First Thursday, C. J. Helton, 61 S. Cherokee, Denver 9, Colo.

**DES MOINES**, Third Wednesday, G. F. McMaster, 304 Hillside, W., Des Moines, Iowa

**DETROIT**, Second Thursday, Michael Pinto, Douglas Tool Co., 3437 Goldner Ave., Detroit 10, Mich.

**ELMIRA**, First Monday, E. C. Bates, 111 Oakwood Ave., Elmira Hts., N. Y.

**ERIE**, First Tuesday, H. M. Rudd, 2717 Cascade St., Erie, Pa.

**EVANSVILLE**, Second Monday, P. W. Vierling, Benerson Corp., 418-424 N. Willow Rd., Evansville 20, Ind.

**FAIRFIELD COUNTY**, First Wednesday, R. W. Smith, 141 Edgehill Rd., Fairfield, Conn.

**FOND DU LAC**, Second Friday, E. J. Kaiser, 530 E. Division St., Fond du Lac, Wis.

**FORT WAYNE**, Second Wednesday, D. D. Welbaum, 2318 Wayne-Wood Dr., Ft. Wayne 6, Ind.

**FOX RIVER VALLEY**, First Tuesday, P. C. Shaner, 203 N. Washington, Batavia, Ill.

**GOLDEN GATE**, Third Wednesday, D. A. Gustafson, 2765 Argyle St., Oakland 2, Calif.

**GRAND RIVER VALLEY**, First Friday, John Ward, Can. General Tower, 52 Middleton St., Galt, Ont., Can.

**GRANITE STATE**, Second Tuesday, J. J. Repetto, Clarostat Mfg. Co., Washington St., Dover, N.H.

**GREATER LANCASTER**, Second Tuesday, R. C. Moorhead, 1912 Sterling Pl., Lancaster, Pa.

**GREATER NEW YORK**, First Monday, H. W. Barclay, New York Times, 229 W. 43rd St., New York, N.Y.

**HAMILTON**, Second Friday, C. E. Bulmer, 43 Whitton Rd., Hamilton, Ont., Can.

**HARTFORD**, First Monday, O. A. Gingras, Pratt & Whitney Div., West Hartford, Conn.

**HOUSTON**, Second Tuesday, H. O. Traughber, 802 Norwood, Houston 11, Tex.

**INDIANAPOLIS**, First Thursday, Joe Penn, 526 Mills Ave., Indianapolis 27, Ind.

**JACKSON**, Third Monday, Theodore Vickers, 726 Griswold St., Jackson, Mich.

**KANSAS CITY**, First Wednesday, M. R. Grundy, 2600 Somerset Dr., Kansas City 5, Mo.

**KEYSTONE**, First Thursday, Jack Lipman, 439 Irving Ave., N., Scranton, Pa.

**KNOXVILLE-OAK RIDGE**, M. B. Hilton, Lester Rd., Rte. 10, Knoxville, Tenn.

**LACROSSE**, Fourth Tuesday, E. J. Giroux, 1035 S. 19th St., La Crosse, Wis.

**LANSING**, Fourth Monday, R. F. Gietzel, Rte. 2, Box 380, Lansing, Mich.

**LEHIGH VALLEY**, Third Friday, J. D. Folwell, 614 N. St. Elmo, Allentown, Pa.

**LIMA**, Third Thursday, A. E. Feightner, R.F.D. No. 1, Elida, Ohio

**LITTLE RHODY**, First Thursday, F. W. Kunath, 29 Taylor St., Cranston, R. I.

**LONDON-ST. THOMAS DISTRICT**, Third Thursday, Louis Jensen, Kelco Eng., Ltd., 352 Thames St., London, Ont., Can.

**LONG BEACH**, Second Wednesday, C. E. Blanchard, 5760 Appian Way, Long Beach 3, Calif.

**LONG ISLAND**, Second Monday, Arthur Cervenka, Vanderbilt Blvd., Oakdale, L. I., N. Y.

**LOS ALAMOS**, First Wednesday after second Tuesday, R. H. Moller, 2146A 43rd St., Los Alamos, N. M.

**LOS ANGELES**, Second Thursday, C. L. Almquist, Almquist Bros., 2300 E. 49th St., Los Angeles 58, Calif.

**LOUIS JOLIET**, Third Tuesday, H. J. Moffat, Caterpillar Tractor Co., Joliet, Ill.

**LOUISVILLE**, Second Tuesday, R. F. Lenz, 3127 Eagle Pass, Louisville 13, Ky.

**MADISON**, Third Thursday, E. C. Helmke, Gisholt Mach. Co., 1200 E. Washington, Madison 10, Wis.

**MEMPHIS**, Second Friday, A. T. Hicks, Hays Machine Tool Co., 269 So. Front, Memphis, Tenn.

**MID-HUDSON**, Second Tuesday, S. P. Cook, Vassar View Rd., Poughkeepsie, N. Y.

**MILWAUKEE**, Second Thursday, E. J. Anspach, Line Material Co., 700 W. Michigan St., Milwaukee 2, Wis.

**MOHAWK VALLEY**, Fourth Tuesday, E. K. Wheat, 301 Otsego St., Ilion, N. Y.

**MONTREAL**, Second Thursday, C. A. Gareau, 1080 Crevier Ville, St. Laurent, Que., Can.

**MUNCIE**, First Tuesday, N. E. Hines, 2106½ So. Washington St., Marion, Ind.

**MUSKEGON**, Paul Hornak, 1917 Seminole Rd., Muskegon, Mich.

**NASHVILLE**, Third Tuesday, W. A. Thornberry, General Machine Co., 715 12th Ave., So., Nashville 4, Tenn.

**NEBRASKA**, Third Thursday, J. A. Duncanson, P. O. Box 148, Seward, Neb.

**NEW HAVEN**, Second Thursday, E. E. Lull, Crucible Steel Co., 131 Park St., New Haven, Conn.

**NEW ORLEANS**, Second Wednesday, L. V. Graham, 4994 Montegue, New Orleans 22, La.

**NIAGARA DISTRICT**, First Thursday, A. A. Clarkson, 154 S. Dr., St. Catharines, Ont., Can.

**NORTHERN MASSACHUSETTS**, Third Tuesday, G. H. Stimson, Greenfield Tap & Die Co., Sanderson St., Greenfield, Mass.

**NORTH TEXAS**, Second Friday, J. E. Franklin, 705 N. W. 9th St., Grand Prairie, Tex.

**NORTHERN NEW JERSEY**, Second Tuesday, W. E. Wheaton, 915 W. 6th St., Plainfield, N. J.

**PATERSON**, C. M. Bazaz, 272 Maryland Ave., Paterson, N. J.

**PEORIA**, First Tuesday, R. J. Zimmerman, Box 91, Roanoke, Ill.

**PETERBOROUGH**, First Thursday, Leendert Hansler, 624 Donegal St., Peterborough, Ont., Can.

**PHILADELPHIA**, Third Thursday, C. R. Pittsinger, 210 Montgomery Ave., Oreland, Pa.

**PHOENIX**, First Monday, C. W. Vermilyea, Motorola Research Lab., Phoenix, Ariz.

**PIEDMONT**, Second Monday, E. N. Dietler, Crucible Steel Co., P. O. Box 2402, Charlotte, N. C.

**PITTSBURGH**, First Friday, L. J. Brozek, 2508 Collins Rd., Pittsburgh 35, Pa.

**PONTIAC**, Third Monday, H. V. Phipps, Cutting Tool Supplies, 88 S. Cass Ave., Pontiac, Mich.

**PORTLAND, ME.**, Second Friday, F. B. Taylor, 18 Birch Ln., R.F.D. 4, Portland, Me.

**PORTLAND, ORE.**, Third Thursday, M. S. Nielsen, 9043 N. W. Leahy Rd., Portland 1, Ore.

**POTOMAC**, First Thursday, G. M. Beck, 7917 Kentbury Dr., Bethesda, Md.

**RACINE**, First Monday, W. E. Swan, Racine Tool & Machine Co., 1760 State St., Racine, Wis.

**RICHMOND**, Second Tuesday, R.H. Culbertson, 11 S.W. 5th, Richmond, Ind.

**ROCHESTER**, First Monday, D. F. Kohler, 240 Vanvoorhis Ave., Rochester 17, N. Y.

**ROCKFORD**, Second Thursday, William Moreland, 3301 Minnesota Ave., Rockford, Ill.

**SAGINAW VALLEY**, Third Thursday, D. A. McMillan, 3316 Court St., Saginaw, Mich.

**ST. LOUIS**, First Thursday, W. J. Potthoff, Rte. 2, Box 64, Graeser Rd., Creve Coeur, Mo.

**SALT LAKE CITY**, Second Friday after first Wednesday, Frederick Preator, 530 N. Third, East Logan, Utah.

**SAN DIEGO**, Second Tuesday, A. E. Crom, 1759 Oliver Ave., San Diego 9, Calif.

**SAN FERNANDO VALLEY**, First Wednesday, Rudolph Regen, 4523 Fulton Ave., Sherman Oaks, Cal.

**SAN GABRIEL VALLEY**, First Thursday, Peter Carter, Rain Bird Sprinkler Mfg. Corp., 19233 E. Foothill, Glendora, Calif.

**SANTA CLARA VALLEY**, Third Tuesday, W. C. Lanyon, 104 Oak Hill Way, Los Gatos, Calif.

**SCHENECTADY**, Second Thursday, G. S. Nelson, 315 Florida Ave., Amsterdam, N. Y.

**SEATTLE**, Fourth Tuesday, R. A. Coady, 6559 43rd Ave., N. E., Seattle 5, Wash.

**SOUTH BEND**, Second Tuesday, J. L. Kemp, 909 Sherman, South Bend 16, Ind.

**SPRINGFIELD, ILL.**, First Tuesday, E. J. Kane, 200 S. MacArthur Blvd., Springfield, Ill.

**SPRINGFIELD, MASS.**, Second Monday, R. M. Dickson, 29 Maybrook Rd., Springfield 9, Mass.

**SPRINGFIELD, OHIO**, Second Tuesday, R. C. Montanus, Signal Hill Rd., Springfield, Ohio.

**SYRACUSE**, Second Tuesday, R. D. Fulford, 309 Melrose Ave., Syracuse 6, N. Y.

**TOLEDO**, Second and Fourth Wednesday, J. J. Kertz, 4554 Willys Parkway, Toledo 12, Ohio.

**TORONTO**, First Wednesday, D. R. J. Few, 85 Northline Rd., Toronto, Ont., Can.

**TRI-CITIES**, Second Wednesday, G. H. Jording, 2015 42nd St., Rock Island, Ill.

**TUCSON**, Second Tuesday, J. D. Beach, 5828 Nogales Hwy., Tucson 2, Ariz.

**TULSA**, Second Thursday, L. W. Williams, 717 So. Marion, Tulsa, Okla.

**TWIN CITIES**, First Wednesday, C. E. Fasth, 2700 29th Ave., N. E., Minneapolis 18, Minn.

**TWIN STATES**, Second Wednesday, George Julien, 26 Smith St., Springfield, Vt.

**WATERLOO AREA**, Third Wednesday, G. E. Osworth, Tecumseh Products, Tecumseh, Mich.

**WESTERN MICHIGAN**, Second Monday, H. J. Swanson, Swanson Machine, 1422 Lake Dr., S.E., Grand Rapids 6, Mich.

**WICHITA**, Second Wednesday, A. A. Reddy, 430 S. Vine, Wichita, Kan.

**WILLIAMSPORT**, Second Monday, W. J. McCoy, 316 E. Central Ave., S. Williamsport, Pa.

**WINDSOR**, Second Monday, J. F. Johnston, 30 Thomson Blvd., Riverside, Ont., Can.

**WORCESTER**, First Tuesday, J. E. Rotchford, Lodding, Inc., 73 Beacon, Worcester 2, Mass.

# News in Metalworking . . .

## STRESSES FACTORS SELECTION FOR DIAMOND ABRASIVES

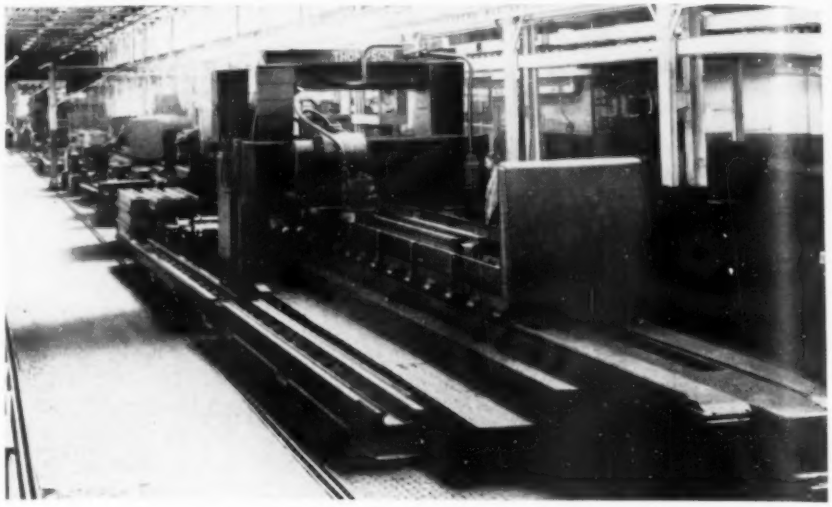
Three points were outlined as forming a "quality check-list" for diamond abrasives by C. R. Myer, manager of the abrasives division of Elgin National Watch Co. speaking recently before the Wire Association convention.

The characteristics to look for are purity, accuracy of grading and particle shape. All of these, he said, can be checked quickly and accurately with a polarizing microscope of 100-200 magnification, and should be so checked for the sake of economy and satisfactory results for the user.

Among the points stressed in the talk were that crushed diamond is superior to other, man-made abrasives. This was reasoned by the speaker from the fact of its extreme hardness and the retention of that characteristic even when reduced to extremely small size. However, full benefits cannot be derived from its use unless it is completely pure. In other words, should a diamond abrasive actually contain only 80 percent diamond and 20 percent aluminum oxide, which by appearance cannot be distinguished with the naked eye, the abrasive can do only an 80 percent job. At the same time, wide variance in particle size will mean only larger particles are working, whih again reduces its efficiency.

The final point was particle shape. Mr. Myer declared that best possible results should come from blocky or cubicle rather than splinter-like particles. Splinters not only are less effective, but tend to scratch the surface of a die rather than polish it.

## GRINDING MONSTER GOES TO WORK



Precision grinding of bed ways up to 32 feet long to the over-all accuracy of 0.0005 inches is possible with the world's largest surface grinder, made by Thompson Products Co., which has been installed at Monarch Machine Tool Co. Dimensions of the 110-ton grinder are 79-ft. length, 13 ft. height and 13½-ft. width.

Four 30-hp motors power the unit, while a 40-hp motor drives the two grinding wheels which can be operated simultaneously. All operations are controlled from a suspended push-button pannel which can be moved to suit the operator.

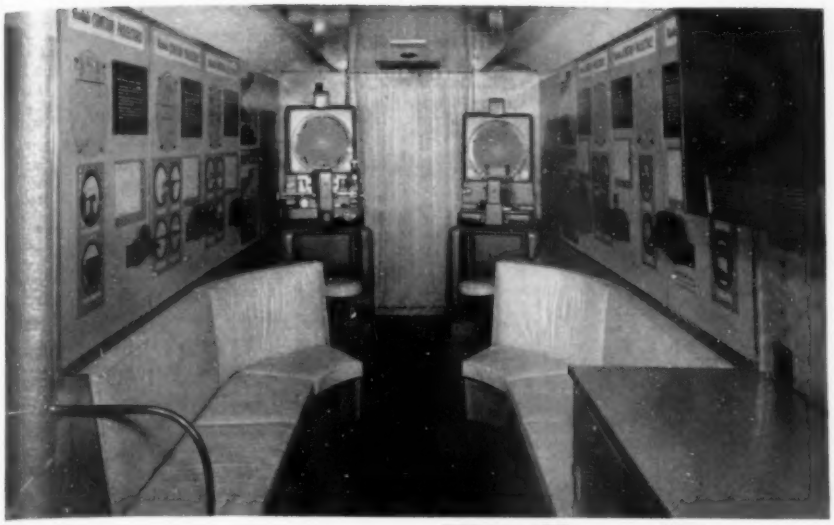
## COLOR TESTING FOR CARBIDES

Powder metal research at Firth Sterling Inc. is covering the possibilities of color metallography in an effort to learn more about sintered carbides, Armour Research Foundation's Industrial Research Newsletter reports.

In the course of the study, specialists have developed a heat-tinting technique. Etched polished samples are heated in a muffle furnace at 900 F for about five minutes. Result is that various phases take on characteristic colors that can be photographed. As a consequence, this technique will give industry an opportunity to examine structure-property relationships.

## INSTRUMENT SHOW GOES ON THE ROAD

Some 40 instruments, ranging from atomic radiation measuring equipment to leak detectors are being made available for on-the-spot demonstrations as a part of the nation-wide tour which has been started by the General Electric Measurement-mobile traveling exhibit. The trailer featuring demonstration and applications of specialty instruments for increased productivity, is scheduled for a year's tour. According to Hudson S. Day, manager of specialty instrument sales for G-E8s Meter and Instrument Dept., it will make more than 250 stops in key industrial areas. Emphasis is placed on applications of instruments in production testing, process and quality control, laboratory analysis, control and analysis of electric utility systems and measurement for service and maintenance of equipment.



Above, **trailer lecture display room is ready for use, and at right an engineer examines equipment at close range.**

## TESTING DISPLAY GOES TRAVELING

Reversing the usual path, a traveling demonstration unit is taking the Eastman Kodak Co.'s Contour Projector to the plant where optical engineers can show the recent advances in inspection and measurement and their practical advantages to the user on his home ground.

By touring the country, the mobile display truck provides an opportunity for all personnel of a plant concerned with problems of measurement and tolerances to see what optical gaging offers for their specific problems. A standard demonstration is offered to show the capabilities of the equipment in a setup that also permits visitors to try their own parts on the projectors to get a better insight into this method.

As a part of the demonstrations, a 20-minute film, "Optical Gaging" is included to present to the viewers a visual comparison between optical gaging and older methods of measurement, and to provide a summary of the demonstrations.

In conjunction with the exhibit, is a display and demonstration of fixtures made by Optical Gaging Products Co. for holding pieces during inspection. While a minimum of these standard staging fixtures are shown, there are numerous specially designed samples, many of which are used incidentally in demonstrations to allow users to examine the possibilities.

More than a year probably will be required for the display truck to complete its scheduled nationwide tour. Manufacturer's representatives in various areas to be visited are arranging bookings.

## HOT EXTRUSION METHOD DEVELOPED FOR STEEL

An important development in the field of hot extrusion of alloy steel has been revealed by Harvey Aluminum of Torrance, Calif., which announces successful production of extruded steel shapes for two military aircraft. These applications, the company feels, now bridge the gap between long experimentation and practical use of the process by which hot alloy steel may be extruded into structural shapes. Until the present application of extruded steel shapes, this method of shaping steel had not been applied to aircraft components. Prime advantages foreseen as a result of the industrial process are cost savings which can be realized over the expensive method of machining the same parts, and extensive savings of materials and manufacturing time.

Extrusion is a simple mechanical operation, and there has been no problem in heating the steel to a temperature so it could be made to flow through the openings of the dies. But complications have heretofore prevented the production of marketable extrusions of steel shapes meeting exacting requirements by industry of dimensional tolerance and physical properties.

Among these complications was the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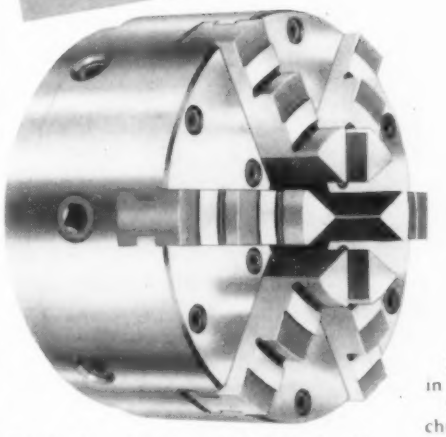

AJUST-TRU Pat. No. 2639157

CHUCKS

This is the only universal scroll chuck with .0005" precision. It is used on lathes, grinders, dividing heads, screw machines. Does most of work formerly requiring stub arbors, mandrels, special fixtures.

6 JAWS

OR 3 JAWS

3-jaw and 6-jaw models in 4", 5", 6", 7½", and 9" sizes. 2-jaw Aviation chucks, for holding odd shaped parts in 6", 7½, and 9".

Save machinists' time — lines up dead true in *one* minute, without shims . . .

Save operators' time — holds .0005" rechucking precision on duplicate parts . . .

Save collet and step-collet costs — the AJUST-TRU does the work of hundreds of dollars worth of collets . . .

Save distortion on tubular work . . .

Save scratches on ground, polished, work . . .

Save time and expensive holding fixtures on many grinding operations . . .

Save chuck wear — it takes up wear in use . . .

More than ever today, you need the economies of Buck chucks. Send for latest catalog.

BUCK TOOL COMPANY

133 SCHIPPERS LANE • KALAMAZOO, MICH.

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prime fact that no satisfactory method had been devised to keep molten steel from destroying the composition of the dies through which it had to pass to form the shapes. Therefore, successful solution partly hinged on creating a superior die material, and perfecting an efficient lubricant to protect the die surfaces from the molten steel being squeezed through.

After conquering these obstacles, Harvey has produced hot extruded alloy steel shapes on horizontal hydraulic presses at temperatures up to 2300 F, in excellent duplication of intricate die shapes up to 30 ft long in a few seconds.

### Properties Compare to Forged Metal

According to the engineers, the metallurgical and chemical properties of extruded steel are as good as hot rolled steel, and the results are comparable to forged material. Advantages it offers are fabrication of shapes too complex to be rolled, production of relatively small lots of special shapes due to low cost of the dies, and fabrication of alloys which cannot be successfully rolled.

As an example of the method's advantages, extrusions made for a particular part for Lockheed were cut into 5-inch lengths, drilled and installed on the Super Constellations without further machining. Cost of the finished product was $8.90, or less than a third of the cost of the same parts made by machining. One aircraft firm estimates the process will save up to 90 percent in time and materials.

### Method Similar to Aluminum Work

In production extrusion of steel is accomplished in much the same way as aluminum extrusion with some delicate refinements and modifications necessary due to different characteristics while heated. Billets or ingots are placed in containers of the horizontal presses, next to the hard alloy steel dies. Rams under pressure up to 150,000 psi squeeze the white hot steel against the dies and the extruded metal shoots out the other end of the dies. To accommodate the metallurgical characteristics of steel ingots under pressure, ram speed of the presses was changed by new valving and container for the ingots was modified.

An important reason for the search for a satisfactory method of extruding steel alloys has been the need for a metal with enduring strength to withstand temperatures generated by aircraft skin friction at today's supersonic speeds. At the same time this material must meet more stringent load and stress requirements resulting from today's design.

**Production More Than Doubled**

***by changing to a***

**KELLER RIVETER**

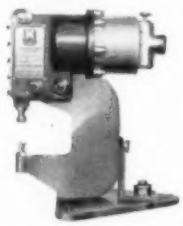
An electronic tube manufacturer boosted production from 62 to 155 pieces an hour by installing a Keller Compression Riveter in place of a kick press for staking the pins in vacuum tube bases. This 150% increase, achieved at relatively small cost, is typical of the results obtained by proper application of Keller Pneumatic Tools.

For riveting, staking, crimping, pressing, and marking operations, and for forcing fragile parts into a pressure fit, Keller Compression Riveters have the tremendous advantages characteristic of air power. They give a squeeze—not a slap—and exert maximum power only at the *end* of the stroke. This reduces shock and spoilage from cracked and broken parts.

*Facts in Brief*

about

**KELLER Compression Riveters**



- Air pressure gives a squeeze—not a slap
- Can be operated by foot valve or hand throttle
- Automatic cycle, stops at end of each cycle
- Portable, bench, or pedestal mounting
- Ideal for pressing, dimpling, staking, forcing, or riveting operations

*Send for* descriptive literature and detailed information

**KELLER TOOL COMPANY**

GRAND HAVEN, MICHIGAN

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## ASHER GUARDS WORKERS

mple adaptation of a familiar ...day safety device is helping ...dard Pressed Steel Co. prevent em... accidents.

...d traffic lights similar to a type ... at railway crossings flash a warn... whenever the overhead crane any ... of three heavily traveled cross... ...s. As an extra precaution, sets of photoelectric eyes keep watch over ... cross-aisle. These are connected ... blinker type warning lights—one ...spended over each intersection. When ... crane comes within 20 feet of the centerline of an aisle, it interrupts a photoelectric beam, red lights in the "danger" aisle start blinking, and continue to flash a warning until the overhead crane has safely passed. This innovation does not halt traffic or work by any means, but it keeps SPS pedestrians warned to keep their eyes open.

## LAMINATE PRECIOUS METAL

A precious metal contact material laminated in ingot form through heat and pressure, then cold rolled to required dimensions, is being made by the D. E. Makepeace Co., Div. of Union Plate and Wire Co. of Attleboro, Mass.

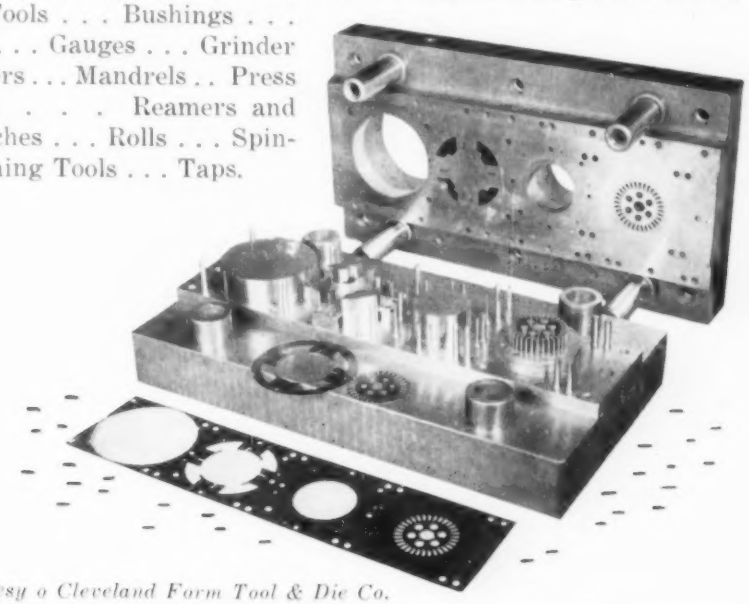
To produce the "Raised-Lay", ingots of precious metal are bonded to a base-metal. The base metal in strip form, and the contacts in the form of a ridge or bar can be laminated into any strip width or thickness. Wearing surfaces are rolled to required tempers to give service life. Contacts from this material may be blanked or formed around the ingots.

Major advantage is the possibility of substituting less expensive blanking cost for assembly operation expense since precious metals are not wasted.


Darwin • NEOR •

for Quantity Production

"NEOR" is the original — and still finest — Oil Hardening, Non-Deforming High-Carbon, High-Chrome Tool Steel. Hardened "NEOR" withstands 240,000 p.s.i. and has not been tested to destruction. Correctly heat-treated, it will not deform or shrink. "NEOR's" high resistance to abrasion make it *first choice* for production in high quantities. Call on your Darwin sales engineer for cost-saving results with "NEOR" on: Brass Finishing and Burnishing Tools . . . Bushings . . . Dies . . . Gauges . . . Grinder Centers . . . Mandrels . . Press Tools . . . Reamers and Broaches . . . Rolls . . . Spinning Tools . . . Taps.



*Courtesy o Cleveland Form Tool & Die Co.*

PRACTICAL RESULTS FROM "NEOR" USERS

**Lamination or Notching Dies** New York firm blanking one quarter hard cold rolled chrome strip (1.25% C, 2% Cr.), 0.015" thick reports increases per grind . . . "NEOR": 60,000—127,000; High Speed Steel: 30,000; Carbon Steel 7,000.

**Coining Press Dies** Detroit automobile manufacturer coin pressed 205,000 in first grind—16,000 with other dies.

**Drawing Dies** Chicago manufacturer of automotive devices produced 20,000 per grind—previous best 400 to 800 (half hour run). Operation was drawing cold rolled strip steel (0.40-0.50 C) and .109" and 0.083" thick.

**Trimming Dies** Philadelphia concern trimming semi-hot steel balls found "NEOR" die operated 25 hours—previous best 4 hours.

**Slitting Cutters** Chicago can manufacturer ran "NEOR" cutters 7 days without regrind—others lasted 1 day.

**Complete line of highest grade Tool Steels, including PRK33, MINEOR, AHT, "MT6" and various grades of Hot Work Specialty Steels. Furnished in bar stock, billet and sand casting. Drill rod, flat ground rod and tool bits.**

***Bulletin on Request.***

DARWIN & MILNER Inc.

*highest grade tool steels*

2345 ST. CLAIR AVENUE ★ CLEVELAND 14, OHIO

REPRESENTED BY

ZIV STEEL & WIRE CO., CHICAGO • DETROIT • ST. LOUIS • INDIANAPOLIS • TOLEDO • MILWAUKEE • M. G. OPP COMPANY, NEW YORK CITY • PECK STEEL & DIE SUPPLY COMPANY, LOS ANGELES • CHARLES B. WEBSTER, PLAINVILLE, CONNECTICUT • CHARLES W. BRINGMAN, ORLANDO, FLORIDA

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-1-111

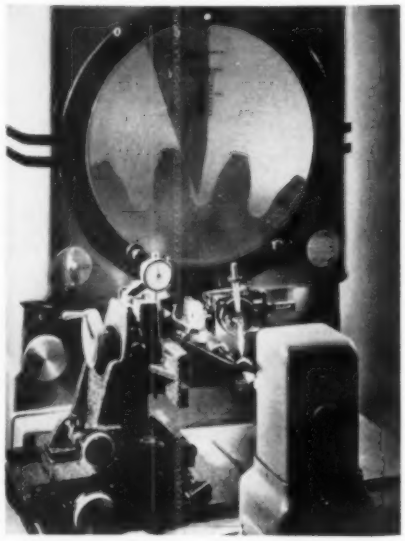
# Tools of Today . . . .

## Gear Analyzer

Optical Gaging Products, Inc., 26 Forbes St., Rochester 11, N. Y., announces a gear analyzer which utilizes optical gaging methods. Known as the OGP gear analyzer, the unit accomplishes gear analysis through direct observation of a magnified gear image which allows inspection, analysis, and gaging of the gear under simulated operating conditions. Thus need for interpolative data is avoided. A list of what the gear analyzer will check includes involute profile, fillet interference or clearance, outside, root, and pitch diameter, and backlash (effective tooth thickness at Standard P.D.), by either center-distance or "slap between teeth."

It also will check tooth to tooth spacing (circular pitch), modified tooth form, tapered teeth, tooth crowning, first and last contact points, and off-axis teeth.

In addition, it checks a wide range of gear sizes without requiring a master gear. Complete analysis of running conditions can be made, even when gear operates with backlash.



In operation the gear is viewed as it rotates in contact with, and at the correct center distance from a composite rack chart. Thus analysis of the gear is made by observing the running action at a magnified projection on a Kodak contour projector. **T-1-1121**

## Solder Paste

Soldering paste compounded of flux and solder which is applied cold, then heated in any way to 375 F to seal, join, or tin most common metals except aluminum, has been announced by All-State Welding Alloys Co., Inc., 249-55 Ferris Ave., New York, N. Y.

The paste offers broad usage in manufacture, construction, and maintenance, particularly due to its ease of application without even a soldering iron. Applications already tested include soldering of multiple wire assemblies, internal tinning, sheet metal work, tubing work, auto body repairs and, when formulated with a special alcohol-resin flux, a wide range of electrical work. In tubing work, pressure tests to destruction (up to 6,500 psi) failed to break soldered joints.

The substance offers economy for the user, convenience and simplicity heightened by its single-step application and the ease of placing the solder exactly where it is needed. **T-1-1122**

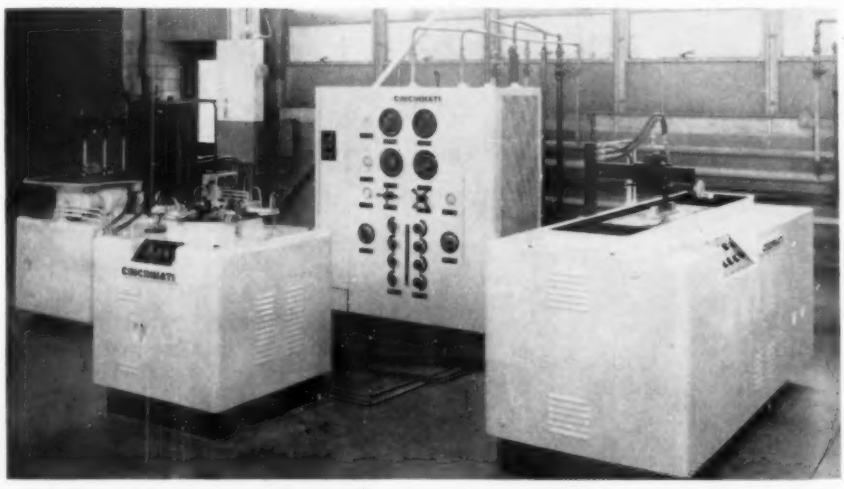
USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

## Power Control Unit

Precise control of fuel gas and oxygen for various selective heating operations is accomplished by a central unit known as the Flamatic power control unit recently announced by The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

This unit accurately meters fuel gas and oxygen to achieve exact control of heat input, controls pressure of water for cooling and quenching, air for actuating cylinders, and electrical power for automatic cycling, and broadens Cincinnati Flamatic applications by permitting the user to employ a variety of simple, low cost tooling permanently set up on the operating units. As a result users can go from one job to another without dismantling the tooling, and then return and re-run a job at any time with duplication of original results.

Three sizes are available, with 2, 4 and 6 mixed gas circuits respectively. The No. 3 unit, the largest built at present, has a maximum capacity of 4,500 Btu per hour, the equivalent of 1320 kilowatts per hour. The power control units operate at top efficiency over the entire range of outputs from zero to maximum.



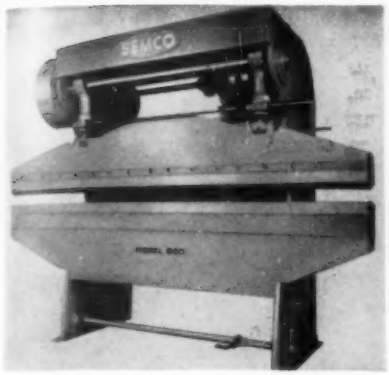
**Flamatic power control unit, in center, is connected with three operating units: for combination hardening, far left, automatic indexing and brazing, left center, and for progressive hardening, at right.**

Catalog No. M-1824, describing the power control unit, is available on request to The Cincinnati Milling Machine Co., Flamatic Division. **T-1-1123**

## Press Brake

A 8-ft. press brake of unusually strong construction and high precision has been announced by Service Machine Co., Inc., 562 Miller St., Elizabeth, N. J. This press brake, designated Semco model 800, is in addition to the 6-ft. press brake that was announced by the same company earlier.

The frame is of one-piece construction, machined in one piece and normalized for relief of strain and to insure accuracy. Some of its dimensions




are: Over-all heights 79 inches; over-all depth 44 inches; depth at base 36 inches; width at base 64 inches; distance from floor to bottom of throat 30½ inches; stroke 3 inches; ram adjustment 4½ inches; strokes per minute range from 16 to 40; motor 1½ hp; rpm 1800; bending capacity 96 inches 16 gage.

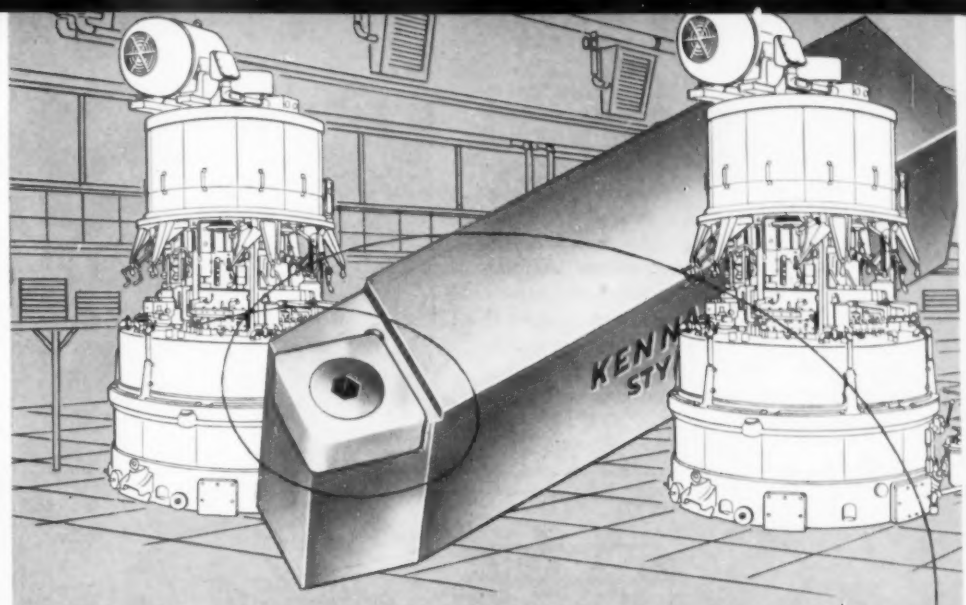
Full ball and roller bearing construction throughout insures long and effortless operation. Further, it is constructed so that the operator will find great ease in handling, and all controls are within his easy reach. **T-1-11131**

## Dew Point Controller

An automatic Dew Point controller which regulates atmosphere dew point in controlled atmosphere metal-treating furnaces has been developed by Ipsen Industries, Inc., 715 S. Main St., Rockford, Ill. This self-contained electronically operated unit continuously records and controls furnace dew point. With the instrument completely automatic heat-treating cycles such as carburizing and carbon restoration are possible.

Adjustable to meet any required dew point within the capacity of the particular furnace to which it is attached, the unit pumps furnace atmosphere through a steel tube. By use of a cooling element, it then condenses water on a measuring device where the conden-



# The Most Critical Point in AUTOMATION

Machine shop automation—the new trend toward automatic conveying, loading, cutting, unloading, and transferring of workpieces—promises great gains in productivity, but it must have cutting tools designed for the operation.

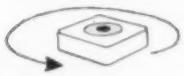
Two features are essential in cutting tools for automation: (1)Durability which enables operation to be sustained with minimum stoppage for tool changing, and, (2)precision-ground, pre-set, multiple-edge tools which permit quick changing when necessary.

Kendex "throw-away" inserts —an exclusive Kennametal development—have both features. Made of Kennametal, they have its high hardness and wear-resistant properties for great durability. Screw-mounted, they can be quickly rotated, in seconds, to new cutting positions. No grinding is required—the insert is thrown away after all cutting edges have been used and quickly replaced with a new preground "button" ... round, square, or triangular as required.

Our engineers, in on the ground floor of automation, have cooperated in developing and applying Kendex, Kennamatic,* and other types of Kennametal tooling to its requirements. The features of this tooling may be the solution to reducing machining and tool maintenance costs—on any operation—in your shop. Ask your Kennametal tool engineer how you may apply it to advantage. Kennametal Inc., Latrobe, Pa.

## KENDEX* tooling keeps AUTOMATION IN ACTION!

**1.** Hard, strong, wear-resistant Kennametal is molded into square, round, or triangular Kendex inserts, which are precision ground.



**2.** Kendex inserts are mounted to suitable holder with socket head screws. When edge becomes dull, insert can be turned, in seconds, to new cutting position.

- *MINIMIZE* downtime for tool changing—a major cause of unprofitable operation.
- *ELIMINATE* tool grinding expense—Kendex inserts are not ground; simply thrown away when all cutting edges have been used.

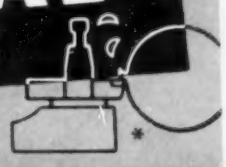
*Registered Trade-Marks

**KENNAMETAL**

CEMENTED CARBIDE TOOLING THAT INCREASES PRODUCTIVITY

A-5

SALES OFFICES IN PRINCIPAL CITIES



sation temperature is measured electrically, then indicated, recorded, and controlled.

Because it functions electrically, the unit is able to measure the furnace dew point directly. Ammonia in the furnace atmosphere does not harm or affect accuracy of the measurement.

By complete and continuous control, the instrument enables the operator to know the exact dew point of the furnace atmosphere at all times. As there is a definite relationship between the dew point of the atmosphere and its carbon potential, automatic control of the furnace dew point assures bright, scale-free results in a wide variety of heat-treating operations. **T-1 1132**

## Roller Bearing

A general-duty, low-cost Tru-Rol steel cage type cylindrical roller bearing is now available with or without a separable inner race from Rollway Bearing Co., Inc., Lipe-Rollway Corp., 542 Seymour St., Syracuse, N. Y.

Its assembly consists of an outer race, roller retainer and rollers. The inner diameter of the outer race has deep, accurately machined ring grooves. Heavy, substantial L-section snap rings fit into these ring grooves, holding in

place the roller retainer and rollers. The roller retainer is a one-piece steel pattern, having pockets with broad double flanges, which keep the rollers in alignment and distribute lubricants evenly.

Depending upon the application required, either type EB with or type B without an inner race can be used. However, the maker points out that if the inner race is not used, the shaft that replaces the inner race must possess the inner race's identical finish and hardness characteristics. If it is not practical to treat the shaft to a Rockwell hardness of 56 to 60 (the hardness range at which the bearing attains maximum capacity) then whatever hardness the shaft possesses governs the bearing's actual capacity.

For more specific information contact the Rollway Engineering Department. **T-1-1141**


ARDCOR *Engineered*

**MEANS BETTER COLD-ROLL FORMING**

*The Production-WISE*

**ROLL FORMING MACHINE...**

**ARDCOR**

**MODEL 1-F**

| | |
|---|---|
| Spindle Diameter | 1½" |
| Roll Diameter | 4¼" to 7" |
| Horizontal Distance Between Spindles | 12" |
| Roll Space on Standard Machine | 10" |
| Capacity Max. | .072 |

ADAPTABILITY — Ardcor Standard Forming Machines feature "unit construction" for each stand. Thus production changes are easily and quickly made. With this feature, any length base can be furnished to accommodate additional units as required.

Ardcor Roll Forming machines embody the precision, accuracy and stability found only in the highest grade machine tools. In addition, Ardcor offers a completely engineered installation—cradle reels, roll forming machines, roller dies, flying cut-off fixtures, etc.—from one qualified source.

Likely as not your special shapes can be ideally handled by a standard Ardcor machine. Your inquiry is invited—without obligation.

***Also Standard Machines up to 4½" Spindle Diameter***

*American* **ROLLER DIE CORPORATION**

29540 Clayton • Wickliffe, Ohio

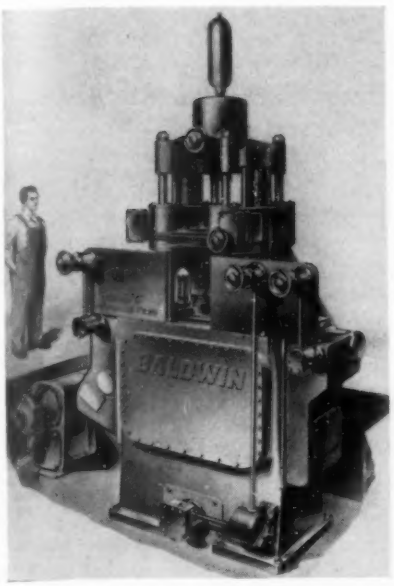
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-114


USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

## Powder Metal Press

A different type press designed specifically for the compacting of powdered metals, built by the Eddystone Division, Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa., is offered as an answer to many problems facing this field. Designated the Baldwin Model "C," it also can be used to compact grinding wheels and ceramic products.

Among its exclusive features are a hydraulic head, floating die holder, an independent floating core rod, a shuttle type feeder, automatic pressure lubrication, and a choice of five different cycles, and in addition a special arrangement




which allows quick, accurate adjustment for changes of density of weight while the press is in operation.

The extreme rigidity of the press, together with the accurate fill control of the die cavity, and the equally distributed pressure produces good compacts at a high rate of production.

As an example of its operation, the press produces Yale lock cylinders automatically at the rate of 20 cylinders per minute. Following the compacting operation, the cylinders are sintered in order to fuse the metal particles.

A folder on the unit, showing specifications and dimensional drawings, is available from the company.

**T-1-1151**

## Alarm Signal

An unusual annunciator system which automatically indicates the sequence of "off-normal" alarms has been introduced by Panalarm Products, Inc., 6312 N. Broadway, Chicago 40, Ill., for where alarms are applied to closely interrelated variables. In most of these applications, if any one of the variables goes "off-normal," the process shuts down. The Visual Sequence Annunciator avoids the difficulty of determining which variable first went "off-normal" and caused the shutdown by indicating the first variable to go "off-normal." This is accomplished either by automatic lockout of subsequent signals, or by causing the first signal to be red and subsequent signals white. A push-button reset feature is also available which causes the sequence indication to start over again.

The systems also are advantageous on dangerous processes where operators want to be sure the entire process has shut down when trouble occurs.

Alarm signals are grouped for sequential lockout by simple jumper connections on the rear terminal block, and any number of interrelated groups may be formed or interchanged as desired. All contacts, relays and other moving parts of Panalarm Annunciators are within hermetically sealed plug-in units.

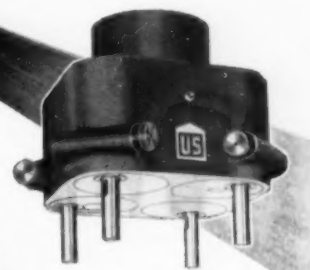
**T-1-1152**


...to protect your investment.... save time, money and labor!

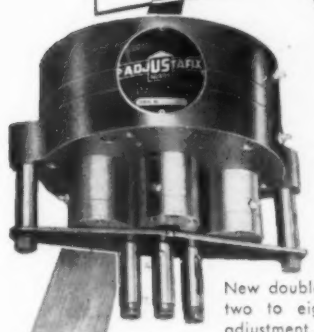
SINCE 1915

US HEADS

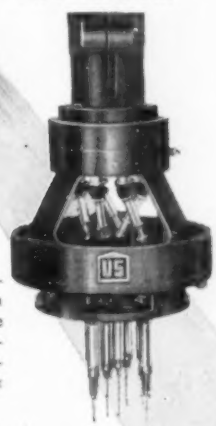
U. S. drill heads are built for continuous use, with full anti-friction bearing construction, for high capacity thrust leads . . . precision-bored, outboard spindle support plate.




Single eccentric type for equally spaced holes on bolt circles.




New double eccentric AdjUStafix, two to eight spindles, for any adjustment. Eliminates the expensive change in set-up from job to job by simply changing the drill pattern plate and relocating spindles. Fully automatic lubrication for either horizontal or vertical operation.



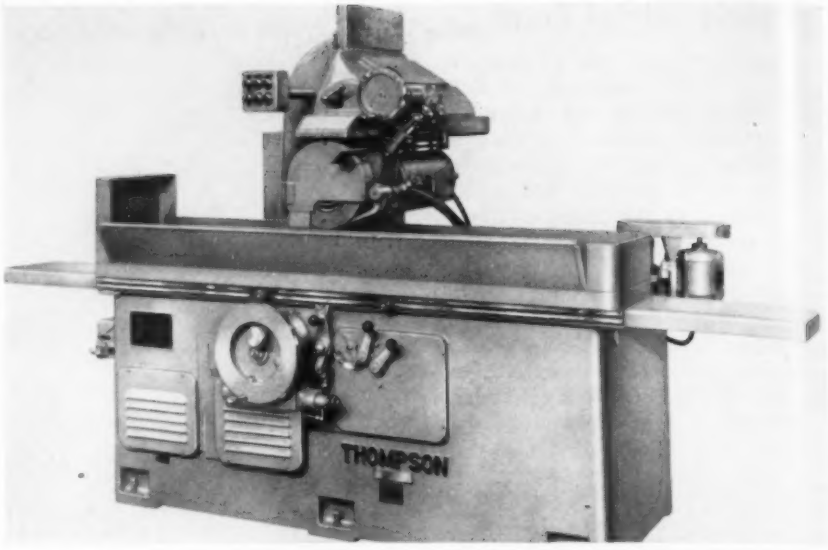

The universal joint adjustable multiple spindle type, an adaptation of a universal joint adjustable spindle, is suitable for any sensitive drilling machine. Joints self-lubricating. Designed for quick change.

*We manufacture all types of multiple spindle, fixed center, adjustable and lead screw tapping heads.*

UNITED STATES DRILL HEAD CO.,
616-618 Burns St., Cincinnati 4, Ohio

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-115

## Hydraulic Surface Grinders




The Thompson Grinder Co., Springfield, Ohio, announces a line of Type B hydraulic surface grinders ranging in sixteen sizes from 6 by 18 inches to 12 by 120 inches, designed for faster, more economical grinding of a jig plate, an intricate lamination die or jet engine parts.

Special features of the units include: Crossfeeding wheel head with horizontal spindle grinding with periphery of the wheel; accurate positioning of work; with patented anti-friction elevating nut; "in position" wheel truing; simplified controls and control panels; smaller increments of down feed and wider increments of crossfeed for quality finish. In addition the grinders have maximum rigidity, flame hardened cross slide ways, integral motor drive to wheel spindle, low pressure hydraulic system, automatic lubrication, built-in coolant system, tape bed way covers, adjustable bronze spindle bearing, proper weight distribution, accessibility for maintenance and manual cross feed.

A number of auxiliary equipment features also are available for use with the units. Among these are: automatic down feed; micrometer backup stop; coolant through the wheel; high speed spindle attachment; dust collector; auxiliary hand table feed; Hoglund magniform contour dressers; Thompson coolant filter; power elevation; magnetic chucks; demagnetizing switches and mg. sets; magnetic coolant separators; rectifiers and neutralators; wheel balancing ways and arbors, and Delpark coolant filters. **T-1-1161**

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

## Punch Press Feed

Jaco Devices, Inc., 101 High St., Hingham, Mass., announces distribution of an automatic coil and strip stock feed for use over a broad range of punch-press applications.

The unit, to be marketed under the trade name of Hydrafeed, is operated and controlled by hydraulic oil which directly couples the rotation of the crankshaft to the reciprocating table.

It uses the principle of the positive displacement pump with a handwheel control for varying volume of oil displaced permitting immediate and infinite adjustment of desired feed length within the limits of the tool from zero to maximum movement. Extreme accuracy can be maintained independent of oil temperature or leakage and the resultant movement of the feed slide is smooth and the speed constant throughout the crankshaft cycle.

Provision is made to permit timing stock movement to start or end at any point in the ram stroke. By opening a bleeder valve, oil is shunted to produce a dwell period up to 60 degrees on each half of press stroke.

The slide table is equipped with openside gripper boxes to permit easy loading of either coil or strip materials. Reversing the grippers will either push the material through the dies or pull it through on the salvage.

Adjustments are provided to raise or lower the feed table within a range of 4 inches to maintain the strip centerline level with each press tool. The table can be moved away from, or up to, the dieset within a 6-inch range of


Automatic—Single Line Feeding
—of Small Parts
with
SYNTRON
PARTS
FEEDERS

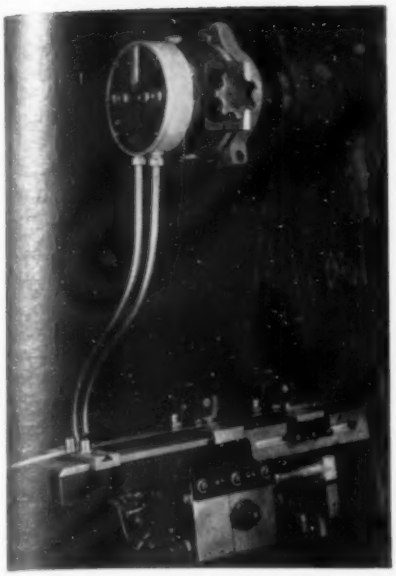
**Syntron Parts Feeders greatly increase capacities and speeds for production handling of small parts. They provide fully automatic, oriented, single line feeding to grinding, packaging, inspecting, and many other automatic machines and processes. Electromagnetic operation—finger-tip controlled feeding of parts of most shapes, sizes, and materials.**

***Write for complete catalogue information—Free.***

SYNTRON COMPANY

340 Lexington Ave. Homer City, Pa.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-116



movement. The slide table is mechanically independent of the press crankshaft and this can be attached according to convenience.

Moving parts have been reduced to a minimum and operation of these parts immersed in oil avoids wear and permits operation of the feed on high-speed presses at ratio commensurate to inertia of stock being fed. No packings are used to maintain tightness of hydraulic circuit, close metal-to-metal fits are depended on to avoid leakage at the only two points such could occur.

The use of the tool is not restricted to punch presses. Any machine having a shaft extension 1½-inch diameter or larger by 3-inch overhang and revolving at a 1:1 ratio with work cycle, where a variable and accurate reciprocal feed stroke is desired can use Hydrafeed.

Capacities of the two models are: 6 inches wide x 6-inch max. feed stroke x 3/32 inch thick, and 12 inches wide by 12-inch max. feed stroke x 3/32 inch thick.

The tool was designed by Birmingham Tool & Gauge Co., Birmingham, England. **T-1-1162**

## Cam Calculator

An inexpensive cam calculator has been recently introduced by Screw Machine Specialties Co., Suite 703, Terminal Bldg., 65 Broad St., Rochester 14, N. Y.

In the formula $Z = 100 \frac{n}{\Sigma N}$ where the total number of hundredths on the cam surface for a single cutting operation is required, the 100 refers to the 100 cam spaces as on the Brown & Sharpe cam marking. For Swiss type automatics, the answer should be divided by 3.6 to convert to degrees.

The total spindle revolutions required for production time ($\Sigma N$) can also be found by converting (dividing by the factor 3.6) to degrees. The lead of the lobe in inches for one complete revolution of the cam (Sp) is found in the same manner.

All other formulas given on the calculator can be used directly without the necessity of converting to degrees.

The calculator is designed for determining quickly and accurately such factors as required rpm; production time for threading; surface feet per minute; total spindle revolutions; hundredths for single operations; and other calculations.

Further, by following a few simple steps, the conventional calculation can be used for swiss cam layout.

**T-1-1171**

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**DICKERMAN LEADS AGAIN . . .**

with the NEWEST DEVELOPMENT in . . .

*Hitch Feeds!*

New 2½" Model K Hitch Feed

FIRST

**NO OTHER FEED — AT ANY PRICE — OFFERS ALL THESE PRODUCTION INCREASING ADVANTAGES!**

**NEW MEEHANITE CASTINGS**
Massive frame of virtually indestructible meehanite makes the new Model K the strongest hitch feed ever built.

**LONGER FEED LENGTH**
Extra frame strength allows full 2½" feed length on stock up to 5" in width.

**CARBIDE GRIPPER PLATES**
Carbide gripper and wear plates are standard on this new, rugged, versatile feed.

Send for LITERATURE and CATALOGS on the complete line of Dickerman MONEY-MAKING FEEDS.

A great, new addition to the Dependable Dickerman line — a feed that will outlast almost any die — trouble free, accurate — day in — day out operation speeds production and actually cuts parts cost up to 60%.

**Dickerman**

H. E. DICKERMAN MFG. CO.

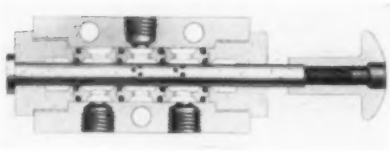
324-216 ALBANY STREET • SPRINGFIELD, MASSACHUSETTS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-117

## Control Valves

Main feature of the newly patented Quick-As-Wink air and hydraulic control valves covers an interior construction for control valves that greatly simplifies the valve, and assures positive positioning of the sealing packers without placing any mechanical pressure on the packers themselves.

Principal parts of the unit, manufactured by C. B. Hunt & Son, Inc., Salem, Ohio, consist of a housing with straight through bore; gland nuts for the ends;



a hollow radially ported ground and polished stainless steel plunger; internal spacers that are held firmly in metal-to-metal end abutment; and two sizes of 0 rings.

In assembly, the 0 rings are placed on the shoulders of the spacers, which are then inserted in the housing. Tightening the gland nuts positions the spacers accurately in the housing and holds the 0 rings in position without subjecting them to any mechanical pressure. The 0-ring packings are subjected only to the fluid pressure in the adjacent chambers, and are supported on both their inside and outside diameters.

No lapped joints, and no metal-to-metal seating minimize friction and therefore wear. All parts are in pressure balance avoiding any tendency to creep or crawl. Normal maintenance consists of occasional replacement of the 0 packings, accomplished easily by simply removing the gland nuts, usually without even disturbing the connecting piping.

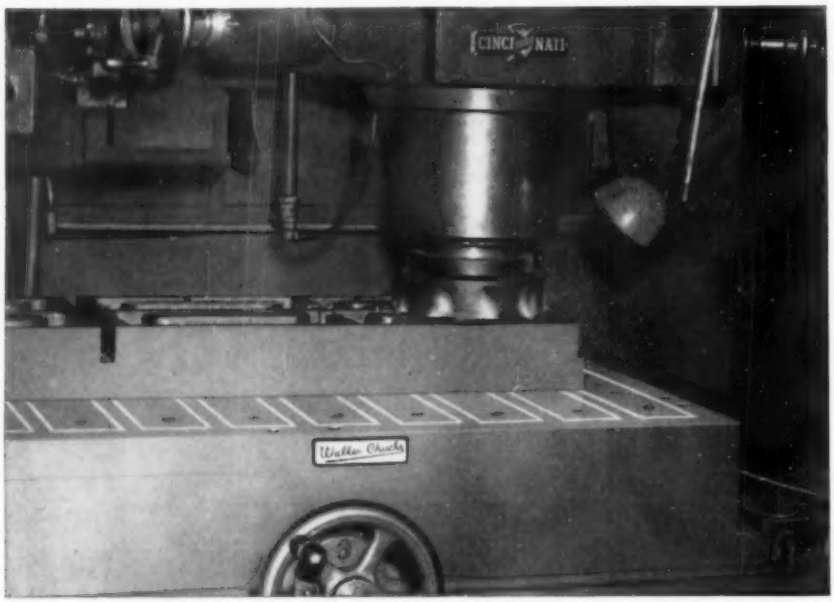
The valves are available in push-pull, push spring return, hand, foot, cam, diaphragm, pilot, and single or double solenoid operated, with 2, 3, 4 or 5-way actions and either open or closed exhaust. Furnished tapped for either $\frac{1}{8}$ or $\frac{1}{4}$-inch pipe connections; for use in either air or hydraulic service, pressures to 125 psi, temperatures to 150 F, also in vacuum service. **T-1-1181**

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

## Sequence Valve

Direct-operating controls, recently announced by The Denison Engineering Co., Columbus, Ohio, offers a complete line of direct-operating sequence valves suitable for operation in circuits from 25 to 2000 psi, providing close synchronization of primary and secondary operations through precision control for interlocked hydraulic operations. Pressure setting of the valve is easily adjusted; when system pressure

*Walker Does It Again—*

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INDICATE A-1-119-1


reaches the pressure setting of the valve, the valve diverts oil to the secondary circuit.

Pressure build-up in the system brings immediate action of the pilot piston in the secondary circuit, which may be adjusted to shift at any pressure from 25 to 2000 psi. The use of the small pilot piston eliminates need for heavy spring loading at high pressures. The secondary operation begins immediately when the pressure reaches the presetting of the valve. These sequence valves are externally drained direct to tank.

Valves designed for operation in the 25 to 125 psi and 75 to 250 psi ranges do not utilize the pilot piston. The pilot pressure is directed against the large area of the spool, resulting in extreme sensitivity to pressure changes in the low-pressure ranges.

Any number of Denison direct-operating sequence valves may be used in the system, either in series or parallel, permitting precise control of several sequential operations being performed simultaneously or in proper sequence with one another.

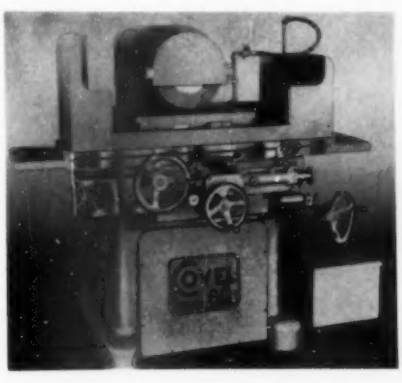
By rearrangement of pipe plugs they also may be adapted to remote control operations.

Valve are supplied in several sizes of threaded body style, with various sizes subplate type. **T-1-1182**

## Surface Grinder

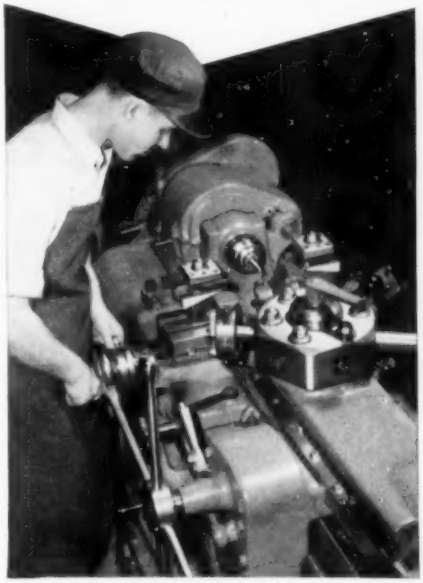
Covel Mfg. Co., Benton Harbor, Mich., has introduced a 15 x 24-inch precision surface grinder with wider feed as part of its 80th anniversary celebration. This model No. 60 is designed to turn out toolroom and production jobs with more precision, at greater speed, less floor space and lower cost.

Features include a 14 x 24-inch work surface, 15-inch width of cross feed, 27-inch table travel and vertical work capacity of more than 18 inches. It is ideal for grinding of trim and mold




A Better Value

SOUTH BEND
2-H TURRET LATHES



South Bend 2-H Turret Lathes have the stamina for exacting close-tolerance work, rigidity for producing fine finishes and ample power for smooth performance. Gear box provides 48 power feeds each for turret ram, universal carriage and double tool cross slide. Such a wide selection of feeds insures all-job range. Where can you find a better turret lathe value? Write for information on this fine machine.

**SPECIFICATIONS**

**Spindle Hole**—1⅜". **Collet Capacity**—1". **Swing**—16¼". **Spindle Speeds**—20 to 945 r.p.m. **Turret Feed**—5⅞". **Dia. Turret Holes**—1½". **Thread Range**—4 to 224 per in. **Motor (2-speed)**—2, 1 h.p.

▶ **$3190** Illustrated, less electrical equipment, f.o.b. factory. Time payment terms: 10% down, the balance in 12 or 18 months.

SOUTH BEND LATHE
SOUTH BEND 22, INDIANA

SOUTH BEND LATHES

INDICATE A-1-119-2

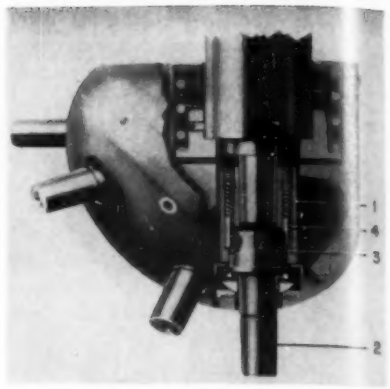
dies, plastic molding and forming dies, form and cut-off tools and variety of other toolroom and production jobs.

It has a table speed of 10 to 90 fpm. Rugged construction allows heavy cuts and also makes for minimum grinding time and reduced costs. Other features of the unit are conveniently located, elevating handwheel below table level, built-in wheel truing device, closed hydraulic circuit, complete dust-protection, powered elevation and automatic lubrication.

More information is available from Covel in Bulletin No. 623. **T-1-1191**

## Drive for Drill Turret

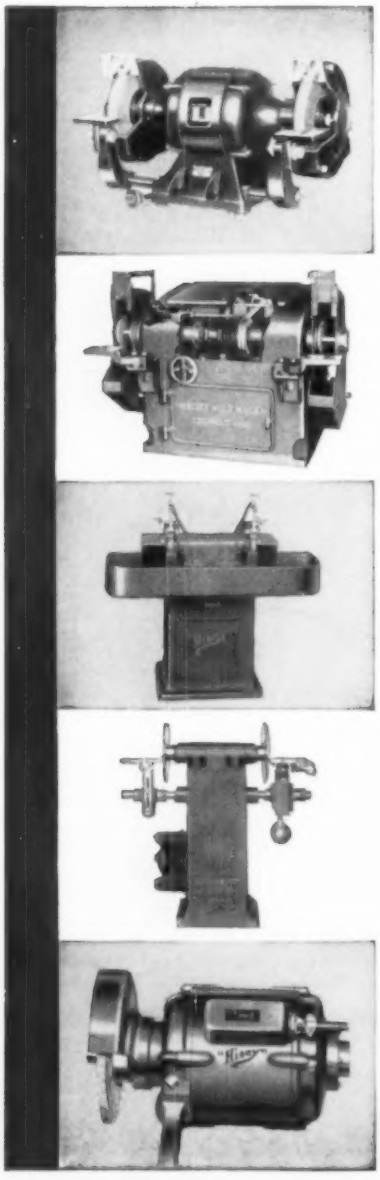
The recently designed Flying Dutchman positive drive is offered as a standard feature of the Model E Lign-o-matic drill turret, designed to increase its capacity and make it possible for any tool to be used that can be held and driven by a ½-in. chuck. It is therefore practical to perform operations well in excess of ½ in. in diameter in the hardest material. The efficiency of the drive is constant, no matter how heavy the torque or how light the end thrust.




The Lign-o-matic is a six-spindle turret for use on a standard drill press. By indexing the turret, six different operations may be performed with a single drill press spindle. The Model E turret may be used to drill, ream, counterbore and perform other drill press operations, and also to tap with reversible spindle machines. Indexing the turret is faster than changing tools or moving work to another spindle.

The basic design of the Model E turret is illustrated. Driver (1) and turret spindle (2) automatically disengage during the last ¾ in. of upward quill movement. The machinist then indexes the turret in either direction to any desired station without stopping the motor. When the quill is lowered, the driver automatically engages the selected turret spindle. Mating tapers (3) automatically align the turret spindle for maximum accuracy. Simultaneously, two spring-loaded pins, or dutchmen (4), automatically engage slots in the turret spindle, providing maximum power.

A brochure describing the Model E Lign-o-matic turret with the Flying Dutchman drive is available from Howe & Fant, Inc., South Norwalk, Conn. **T-1-1201**

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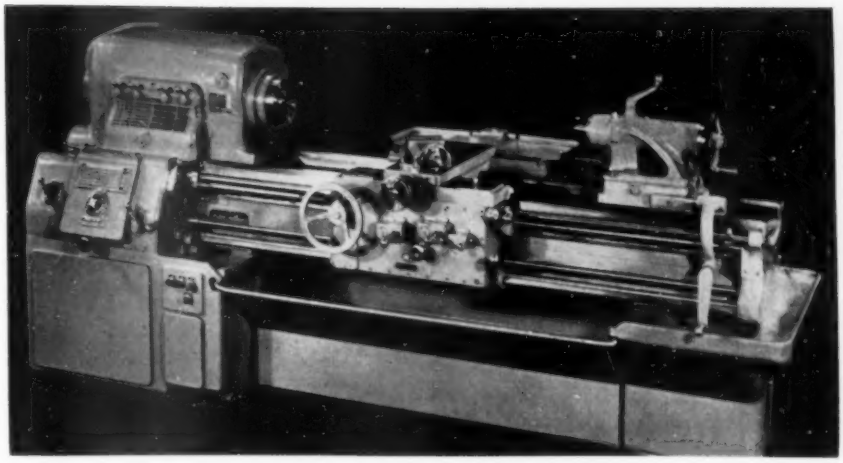
## Plating Bath Control

R. O. Hull & Co., Inc., 1300 Parsons Court, Rocky River 16, Ohio, announces its Model "WT" Hull cell, phich provides a simple and accurate method for control of plating baths operated at elevated temperatures.

The complete unit consists of a Lucite Hull cell mounted with a water-proof, variable-control thermostat containing a pilot signal light. This is connected in a series with a 110-volt, a-c or d-c, quartz immersion heater located in the base of the unit. The thermostat automatically controls temperature at plus or minus 3 F. The new cell uses the same size cathode as the 267 ml. Hull cell. **T-1-1202**

## Lathes



The Monarch Machine Tool Co., Sidney, Ohio, has developed a Series 61 line of engine and toolmaker's lathes incorporating power rapid traverse and other important design refinements and construction improvements for precision performance under continuous, heavy-duty service conditions.

Models, available in 13, 16 and 20-inch sizes, include built-in apron-controlled power rapid traverse to the carriage and cross slide in a full range of swings.

According to the maker, this design feature provides rapid tool positioning, quick tool retraction, and fast carriage return, and results in tool adjustment time on most work being reduced by about 50 percent.

Longitudinal movement, right or left, is 160 ipm, and cross-movement, in or out, is 75 ipm. A safety clutch is provided for all traverse movements, which disengage automatically if they jam accidentally. A direct-length reading dial is built into the apron, and facilitates multiple diameter turning and blind hole boring.

Other design and construction features include totally enclosed gearbox and end gearing, automatic pressure lubrication, antifriction bearings, helical-geared headstock utilizing ground or shaved gears, American standard Camlock spindle nose, flame-hardened and precision-ground integral bedways, and all critical parts made of hardened alloy steel.

In addition to the standard sizes, these lathes are also available in numerous plus-swing sizes. Leadscrew, feed rod, control rod and traverse rod on longer bed units are continuously supported by traveling carriers. They are automatically picked up or dropped off by movement of the apron.

**T-1-1211**

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## Impact Press

An all-pneumatic impact press has been brought out by Heidrich-Nourse Co., 631 East Third St., Los Angeles 13, Calif.

Among its principal features are complete uniformity of impact force on workpieces varying considerably in thickness, operator safety, and a speed up to 10,000 complete cycles per hour.

In operation a variable stroke air hammer or piston-ram moves within a closed cylinder and strikes a chuck projecting through the bottom of the cylinder. Length of hammer stroke or travel inside the cylinder is adjusted by the large hand nut at the top, which changes the position of the inner cylinder head.

When the foot-valve pedal is pressed the cylinder assembly with chuck and tool is brought into contact with the work by a hydraulic traverse mechanism, and the impact follows. The traverse and the impact stroke are in linked sequence, but each is adjusted independently. Clearance height of the tool above the work is set by moving the head assembly on the column.

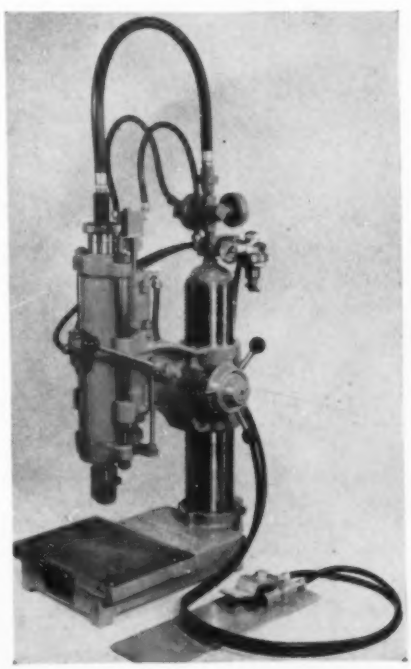
On work of uniform thickness the clearance may be as little as 0.005 inch, and the machine still will deliver an impact of any desired force from 30 to 30,000 lb.

On work that varies considerably in thickness the vertical clearance may be set for the thickest piece, and within the traverse range of 2¼ inches the impact will be uniform on all pieces without further adjustment.

There is no flow of air except during the operating cycle, and air consumption is low. The machine is entirely air-operated and has no electrical parts.

The press may be used on impact operations, either one-shot or progressive operations, including impression marking, stamping, staking, swaging, upsetting, riveting. With the addition of a time-dwell valve it may be used for squeezing and heat branding without impact.

**T-1-1212**



## Corrosion Resistant Filter

Porous Plastic Filter Co., Glen Cove, N. Y., one of the Pall Filtration Companies, announces the availability of compact in-line filters for highly corrosive materials such as fuming nitric acid, hydrogen peroxide, and hydrochloric acid.

The filter medium is porous Kel-F, considered completely resistant to all common acids and gases in all concentrations, as well as to common organic chemicals. It also is impervious to highly oxidizing media such as concentrated hydrogen peroxide, and also to severe reducing agents. The substance also is unusual in that it presents a large surface area, yet does not catalyze the decomposition of hydrogen peroxide.

Standard porous Kel-F filter elements will remove all particles larger than five microns in liquid filtration, and much

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finer particles in gas filtration, can be used at temperatures up to 350 F and are resistant to thermal shock. This filter medium has tensile strength of 900 psi and a modulus of elasticity of 18,000 psi.

Typical example is the fuming nitric acid filter uses porous Kel-F filter segments with stainless steel separator rings, and is housed in a stainless steel container. For filtration of materials corrosive to stainless steel, other suitable metals and alloys are available. Availability of an all plastic unit is expected shortly.

Units are designed for ready accessibility for cleaning and can be disassembled and reassembled in a few minutes with simple tools, thus allowing for cleaning of the individual filter segments. Single segments can be replaced inexpensively from stock in cases of accidental damage to a filter element. Pressure drops are very low. A practical rating for commercial fuming nitric acid is 1 gpm/sq ft. At this rating, adequately long cycles are obtained between cleanings.

Complete filters are available from fractional square foot surface area up to 50 sq ft of filter area. Larger units can be made on special order.

**T-1-1212**

## Test Cabinets

A line of multi-range, all purpose test chambers capable of producing low temperatures to –130 degrees F, high temperatures to 200 degrees F and a standard humidity cycle of 20 to 95 percent from +35 degrees F to +185

degrees F, has recently been introduced by Murphy & Miller, Inc., 1326 S. Michigan Ave., Chicago, Ill.

Made in five sizes with test space capacity from 4 to 36 cu ft, these units incorporate many unusual features designed to provide faster, easier and

accurate testing.

high capacity, low velocity forced air circulation system provided by a fan whose motor is mounted outside the test space, reduces temperature variation in all parts of the test space to an absolute minimum. Cabinets are heavily insulated with nonsetting, low conductivity material. Welded seams on the heavy gage steel exterior panels assure positive vapor sealing of the insulation. Test spaces are stainless steel with welded watertight seams and include as standard, four $\frac{5}{8}$-inch ID sleeved openings for introduction of electrical leads, hydraulic lines, etc. Another feature furnished as standard is an electric defrost system complete with safety controls, to prevent condensation on products being tested by increasing their temperatures to ambient before removal from the test space. **T-1-1221**

## Valve Line

A line of diaphragm motor control valves, incorporating a number of engineering improvements, was announced recently by the Industrial Div. of Minneapolis-Honeywell Regulator Co., Wayne and Windrim Aves., Philadelphia 44, Pa.

Series 800, as the valve is designated, was designed for use with wide-band, proportional control instruments widely used in industry, and features a completely redesigned diaphragm motor with pressed steel case plates. It also offers a sturdy yoke with mounting bosses on both sides for auxiliary equipment; a unique locking arrangement for securing the body stem to the spring stem; and either bolted or screwed stuffing boxes.

Further, the line incorporates direct-acting, reverse-acting and springless diaphragm motors, for operation of either double and single-seated straight-through bodies or for Venturi, three-way and low flow types of bodies.

Available with this line of valves is a line of solid, V-ported, double-seated plugs, plus an additional spring range of 6 to 30 psi. **T-1-1232**

## Air Tools

Three series of air tools, covering applications from $\frac{1}{4}$-inch drilling to $\frac{3}{4}$-inch bolt size nut setting, have been announced by Thor Power Tool Co., 175 N. State St., Aurora, Ill. They are the No. 3, No. 35 and No. 5 series, all featuring extensive interchangeability of parts within each series group.

In the first of the No. 3 series released, one basic air motor powers four straight drills (which are convertible to direct drive nut setters), four right-angle drills, and four right-angle nut setters. Speeds will range from 3400 to 800 rpm with capacities of $\frac{1}{4}$, $\frac{5}{16}$ and $\frac{3}{8}$ inch.

The No. 35 series initially released features three grip handle drills in speeds of 1150, 800 and 550 rpm, and capacities of $\frac{3}{8}$ and $\frac{7}{16}$ inch. The drills are convertible to direct drive nut setters of $\frac{5}{16}$-inch thread size capacity.

In the No. 5 series, right-angle nut setters are offered in speeds of 600, 450, 300 and 225 rpm for setting nuts of $\frac{1}{2}$, $\frac{5}{8}$ and $\frac{3}{4}$-inch thread size.

Full details are available in bulletin JE 1690 from the company. **T-1-1233**

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

## Metal Saw

Speedy-Cut, a 6 x 6-inch capacity metal sawing machine has been introduced into its line by the Peerless Machine Co., 1600 Junction Ave., Racine, Wis.

Although designed for the lowest price field, the unit maintains the quality features. A rugged, accurate two-speed machine for general purpose use, it has an actual capacity of $6\frac{3}{4}$ x $6\frac{3}{4}$ inches. A broad shouldered "U"-type over-arm is accurately machined and

the saw blade is held with great rigidity by special flat steel blade holders. Adjustible gibs on top and side of the saw frame guide compensate for wear.

Features of the unit include a trip switch, which automatically stops the saw at the end of each cut and which automatically stops the motor, disengages the feeding mechanism at the completion of each cut and allows the frame to automatically rise to its starting position. In addition it has a centrifugal pump for dependable coolant flow, and massive vise jaws which hold all work firmly. Rear vise jaw can be


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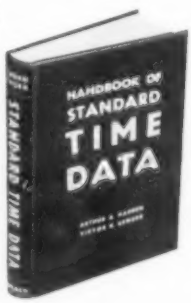
## For Machine Shops

*By* ARTHUR A. HADDEN, *late President; and* VICTOR K. GENGER, *Vice President, McClure, Hadden & Ortman, Inc., Management Engineers*

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INDICATE A-1-124-1

set at the required angle and the front movable vise jaw automatically adjusts itself to the work angle. A compensating feeding mechanism automatically adjusts itself to the size and shape of the work. For finer adjustments for varying pressures, Speedy-Cut is provided with a feed adjusting handwheel and a pressure indicator and graduated scale which can quickly and easily be read by the operator.

A ¾-hp electric motor powers the unit and the two-speed V-belt drive (fast for softer metals and slow for tool steels) is controlled by a step sheave. **T-1-1231**

## Clutch Air Valve

Specifically designed to avoid accidental stroking due to valve failure, this dual air valve consists of two independent pilot operated valves, actuated by electromagnets, and the main valves by air. Pilot valve construction appreciably reduces inrush and holding current requirements. The two independent valves are built into a single unit and cross ported in such a way at to provide maximum safety.

Should either side of the valve be accidentally held open, the other side

of the valve continues to function normally through the independent action of its electromagnet, exhausting the clutch and bringing the press to a fast, safe stop.

According to the maker, Danly Machine Specialties, Inc., 2100 South Laramie Ave., Chicago 50, Ill., this safety factor of the construction is not dependent on the mechanical life of the valve.

The Danly valve can be installed on a press with a pressure switch so that should either side of the valve fail to function, the resulting drop in pressure in the air supply tank will break the control circuits and prevent further press operation until the trouble is corrected. **T-1-1241**

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INDICATE A-1-124-2

## Air-Hydraulic Vise

Wilton Tool Mfg. Co., 925-541 Wrightwood Ave., Chicago 14, Ill., has announced development of a line of power operated vises to be marketed under the name of WiltOmatic.

A convertor cylinder between the foot control and the actual vise transforms and multiplies comparatively low incoming air pressure into powerful hydraulic pressure to produce necessary locking forces, and still maintain a compact vise mechanism.

Among the most important points about this power operated unit is the

ease with which the vise can be changed from one jaw opening to another. Since the regular vise screw and handle are the master control for the vise, the static jaw setting can be varied merely by rotating the handle of the vise, thereby making the unit usable both as a power operated and a manually operated vise simultaneously. Jaws of the WiltOmatic can be adjusted to travel anywhere from 0 to ¾ inch with each operation.

Force of the mechanism is revealed in the stated specifications: rated locking force between jaws is 3,000 lb; rated air pressure at intake is 100 psi; and rated hydraulic pressure is 830 psi.

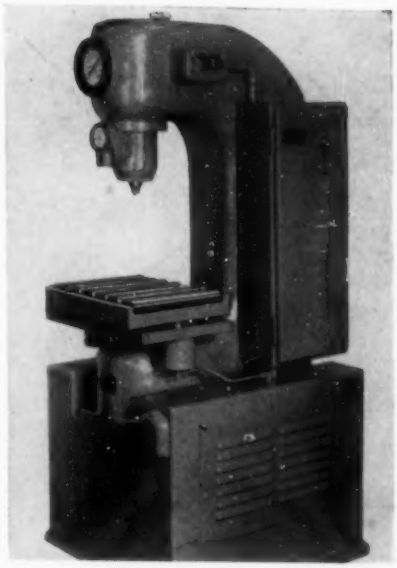
In addition, the company announces that conversion kits which will transform a conventional Wilton vise into a WiltoOmatic, quickly and simply, also will be available, supplied with either a foot or hand control. Currently, the vises are available in 4, 4½ and 5 in. sizes. **T-1-1251**

## Hardness Tester

A production model Brinell Hardness testing machine, designed to fit directly into a conveyor system, is announced by Steel City Testing Machines, Inc., 8817 Lyndon Ave., Detroit, Mich. Adapted from the company's standard hydraulically operated direct reading type of tester, the unit greatly facilitates handling of parts and thereby speeds up the testing process.

Highlight of the design is a roller conveyor arranged in conjunction with the anvil of the tester. The anvil itself consists of a series of hardened steel bars firmly affixed to the lower portion of the machine's C frame. Between these bars are interspersed the rollers of the conveyor, which are lowered and raised automatically during the cycle.

Production cycle of the motor driven,



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Hammond Machinery Builders INC.

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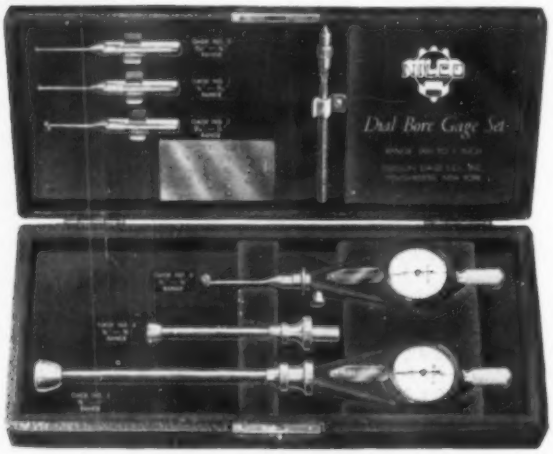
SAVE

**$250 on precision DIAL BORE GAGES**




6-Gage Economy set range .090" — 1".

Save 25% by purchasing these beautifully designed, long lasting NILCO Dial Bore Gages in sets! They are interchangeable

Save on production costs! Operators using NILCO Dial Bore Gages *see* the condition of the holes and control the size right at the machine. Better parts and fewer rejects are the result.

**NILSSON GAGE CO., INC.**

**Poughkeepsie, New York**

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**one of the largest multi-engine aircraft modification centers in the United States and now designing many prototype installations and manufacturing kits for the Air Force.**

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**Write to:** *Manager of Employment*
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**P.O. Box 2287 Birmingham, Alabama**

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hydraulically operated Model DR-10X is as follows: Parts are fed to the machine on a delivery conveyor the same height as the conveyor on the tester. The operator rolls the part into position beneath the ball penetrator and momentarily depresses the knee switch. The roller conveyor automatically lowers, allowing the part to come to rest on the anvil bars. Then the ball penetrator automatically lowers applying the load and making the Brinell impression. An electric timer holds the load for a selected interval after which the penetrator rises, the roller conveyor rises, and the operator rolls the part off the machine onto another matching conveyor which carries it on to the next operation.

A direct reading dial acts as a comparator indicator, indicating the depth of the Brinell impression during production testing. Two hands on the indicator are used to show the hard and soft limits allowed on the particular job being run. If, during a test, the indicator hand stops between the tolerance hands, the part is known to be within the required hardness range. Travel too far shows a soft part; not far enough, a hard part. **T-1-1252**

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

## Replacement Cylinders for Plating Barrel

A complete line of replacement plating cylinders has been designed to save large investments of platers who have old and obsolete barrel superstructures which otherwise would be a total loss. The replacements, made of "H-T Sincolite" to fit all standard makes of barrel superstructures, old and new, are offered by The Singleton Co., 5317 St. Clair Ave., Cleveland, Ohio.

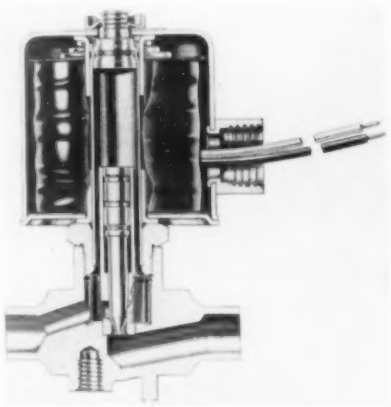
"H-T Sincolite" (H-T Lucite and Plexiglass), introduced by Albert Singleton, president of the company, as a perfect material for plating cylinders 6 years ago, is resistant to acids and

alkalies, nondeteriorating and noncontaminating, transparent, lightweight, rugged, and lasts indefinitely. The units consist of two heads, six [illegible]-rails and five panels, with a tensile strength of 10,000 psi. With no dangerous stresses from heating and bending, they hold their shape permanently without distortion in temperatures up to 200 F. The Singleton perforation pattern provides 17 percent more holes per square inch in panels for better, faster plating, yet it is structurally stronger. Included are all necessary installation accessories. A new bulletin RC-101 is available on request. **T-1-1261**

## Solenoid Valve

An improved model of their Model 73 solenoid valve has recently been announced by A-P Controls Corp., 2450 N. 32nd St., Milwaukee, Wis.

This model incorporates double-dipped, varnish-impregnated coils to assure efficient performance under extreme humidity conditions. The coil is easily changed to suit voltages required for special applications. An electrical data plate accompanies each interchangeable coil. When a coil is



changed, the new plate is fastened under the coil cover nut, and thus the identifying data on the valve is correct at all times. Since the coil cover is held with one nut, it can be rotated through 360 degrees to simplify electrical connections.

The valve is equipped with a long-life, quiet-floating plunger, and the valve needle and seat are protected against dirt by a removable, noncorrosive screen.

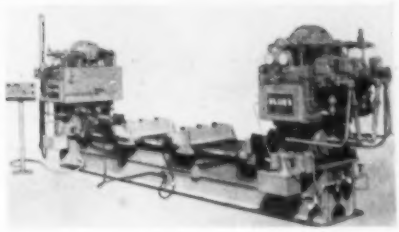
Designed for use with any noncorrosive liquid and for refrigerants or air, the valve may be obtained in three orifice sizes—$\frac{5}{32}$, $\frac{3}{16}$ and $\frac{7}{32}$ inch, and for $\frac{3}{8}$ N. P. T., $\frac{3}{8}$-inch flare and $\frac{5}{8}$ or $\frac{1}{2}$-inch sweat connections.

**T-1-1271**

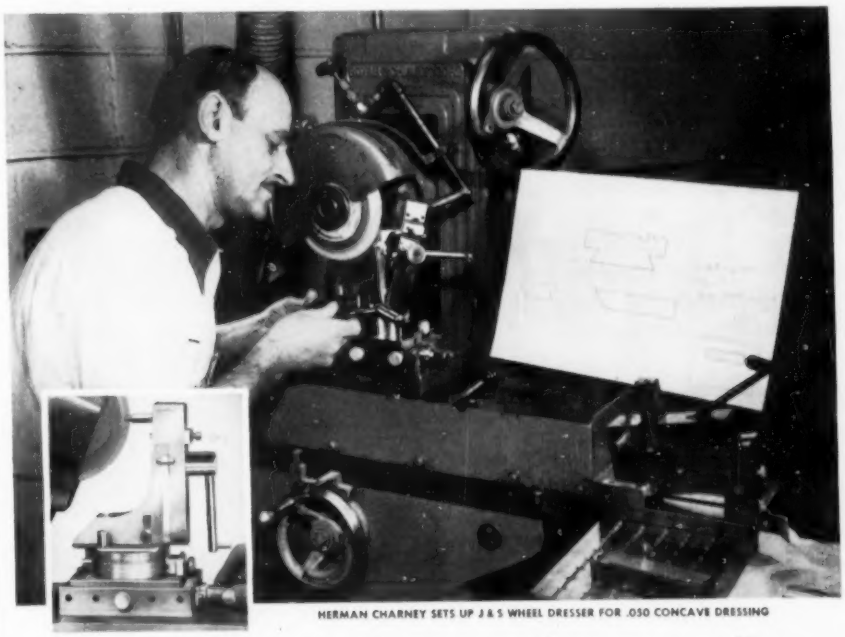
## Tube Reducer

The Elmes double-end tube reducing hydraulic press is specially designed to reduce both ends of a 2-in. diameter seamless steel tube simultaneously. This two-station machine uses a preliminary reduction as well as a final reduction die, mounted internally in each ram along with an internal automatic hydraulic knockout in each ram. As the ram returns, after the reduction, the knockout automatically ejects the tube.

To accommodate tubes varying from



3 to 12 ft in length in increments of 6 inches, one cylinder block with its accompanying pumping unit and controls can be moved along the bed by means

HERMAN CHARNEY SETS UP J & S WHEEL DRESSER FOR .050 CONCAVE DRESSING

# Saves hours by setting angles in seconds, radii in minutes

**A typical job made easier with a J & S "Fluidmotion" Wheel Dresser**

Here's a wheel dressing job which calls for 13 angles, 4 radii, 7 flats. Ordinarily you might expect to spend from 5 to 30 minutes for each setting. With a J & S "Fluidmotion" Wheel Dresser, tool grinder Herman Charney made *all* 24 settings in just 21 minutes.

**Time-saving Features**

An unusual case? No — it's typical of the speed and ease of operating a J & S Wheel Dresser. Setting 2 angles with a "Fluidmotion" Dresser, for example, takes only 10 seconds. Setting a radius takes only 2-3 minutes.

Note just *how* easy it is to operate a J & S Wheel Dresser. All you need is a micrometer and a simple hex wrench. You can forget about gage blocks, height gages and master gage settings. No need to bother either with parallel bars, surface plates or dial indicators.

With the "Fluidmotion" Dresser, you can also dress two angles tangent to a radius in one continuous motion. After dressing the angles, the diamond automatically returns to center.

**Accurate to 0.0001"**

Accuracy? You can make concave and convex contours at a full 180 degrees with a guaranteed accuracy of 0.0001". J & S dressed forms, too, are always clean and precise. Angles and radii *flow* into each other, free of tool or chatter marks.

These are some of the benefits you get when you use a J & S "Fluidmotion" Wheel Dresser. A variety of models are available for dressing wheels up to 24" in diameter. Construction in all cases is of high carbon, high-chrome steels.

*Write for complete information today*

J&S TOOL CO., INC.

WHEEL DRESSERS • JAW CLAMPS • PRECISION VISES • SINE BARS • DOWN-HOLDING DEVICES

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Startling production results — and savings — are guaranteed by B. Jahn dies because each is engineered with ingenuity and craftsmanship that pays off throughout prolonged die life . . . designed for performance *and performance alone* . . . "production proved" to work — and keep on working — in the customer's equipment to his complete satisfaction.

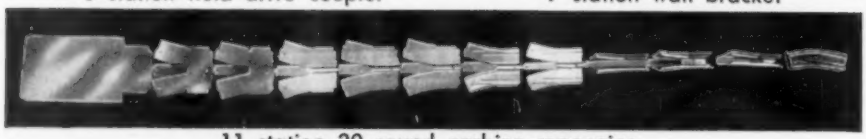
PRODUCTION B. Jahn PROVED

**DIES**

11 station toe plate for ice skate

6 station fluid drive coupler

7 station wall bracket



11 station 30 round carbine magazine

8 station parachute buckle

9 station car cigarette lighter part

**ACTUAL CASE HISTORIES DEMONSTRATE HOW B. JAHN DIES BREAK PRODUCTION RECORDS . . . DELIVER MORE PARTS PER DAY, PER DIE, PER DOLLAR!**

Send today for the fact-packed, picture story of "B. Jahn Production Proved Dies."

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THE B. JAHN MANUFACTURING COMPANY, NEW BRITAIN, CONNECTICUT

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of a motor-driven lead screw. Keys across the bed take the thrust load. Tubes are fed automatically through the machine. Air-operated tube clamps are used for the longer tubes, eliminating any tendency to bow during reduction. The tube ends are lubricated prior to reduction by two lubricant pump and reservoir units, one for each end of the press.

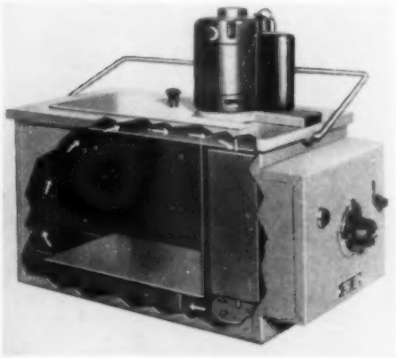
Fully automatic in operation, the unit is capable of producing at the rate of 150 tubes per hour. The press can be designed to accommodate a wide range of tubing diameter and lengths.

Further details on this press are available from the manufacturer, American Steel Foundries, Elmes Engineering Div., 1150-2 Tennessee Ave., Cincinnati 29, Ohio.

## Dipping Tank

Globe Imperial Corp. have added to their line of production dipping tanks for Plastic Seal hot dip protective coatings a bench-type model of 14-lb capacity. The P/S 7 tank is offered with or without an agitator.

With the positive agitation created by the impeller type agitator, and special heating elements which radiate heat direct to the sides of the tank, more rapid heating and cooling is accomplished. This tank is equipped with



115 v, a-c, single phase, 60 cycle. Special models are available in 115 v, d-c, 230 v, a-c or d-c.

Known as P/S 7 Globe Imperial, this production dipping tank is equipped with a Robertshaw thermostat that maintains the temperature of the plastic automatically. Tests have shown it heats material from room temperature up to 360 F in about one hour. Positive agitation gives a constant level in the dipping area for mechanical conveyor dipping operations.

Complete details and price information can be had from the Globe Imperial Corp., 2023 Kishwaukee St., Rockford, Ill. **T-1-1281**

## Impact Tool

Ingersoll-Rand Co., 11 Broadway, New York, N. Y., has announced a size 2U electric Impactool designed for economy of time and effort on nut running, tapping, screw-driving, reaming, drilling, etc. jobs. Rated for nut running up to ¼-inch bolt size, the 2U Impactool automatically delivers a series of powerful rotary blows to the work when resistance to turning is met, without kick or twist to the operator.

This electric Impactool weighs only five pounds, measures 9⅜ inches overall, side to center distance 1 15/32 inches. The motor cannot be burned out by overloading, and will operate from any 110-volt source, a-c (60, 50, 40 and 25 cycles) or d-c.

The practically frictionless ball and cam impact mechanism converts the

full motor power to useful work with low current consumption and less heating. Separate grease sealed ball bearings assure accurate motor armature alignment. Beryllium copper brush springs retain spring temper under all conditions and at the same time transmit the current, eliminating the need for troublesome "pigtails." The trigger, which is independent of the switch, has a chrome-plated shank and operates in a steel insert bushing for long, trouble-free service and resistance to wear. The heavy-duty switch has extra current carrying capacity to eliminate burnouts. **T-1-1291**

## Automatic Torque Wrench

Reasor Mfg. Co., St. Charles, Ill. offers a patented wrench designed to tighten nuts, bolts and screws to exact predetermined tension, automatically, without the need for warning signals. For use wherever precision counts—particularly in the manufacture and maintenance of aircraft, automobiles, trucks and tractors. An automatic trip-action feature averts human error since the operator is not obliged to watch a dial, gage or indicator or mechanical warning device in order to determine the tension applied. To operate the tool the micrometer-style adjustment in the

handle is set at the exact tension desired; the handle is then pulled until that tension is reached, at which point the wrench "breaks" automatically. There is no possibility of flexing of beams or rods, and the tool cannot be overloaded. The design, which is constructed so simply that it may be used by even the most inexperienced operator, saves time and energy, increases operating speed and assures accuracy.

Circular, "Exact Tension Every Time," is available from the company. **T-1-1292**

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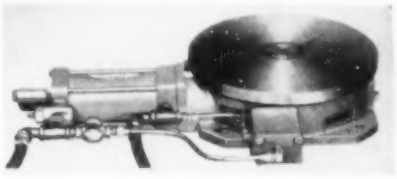
## Index Table

On the larger air index table Model No. 1405, announced by Air-Hydraulics, Inc., 263 Belden Rd., Jackson, Mich., both the cushioned stop and air speed are adjustable to compensate for variations in load weights and diameters. As loads and diameters are increased, cushioning can be increased to allow maximum speed of operation without damage to the mechanism or work.

This table has basically the same in-



dexing mechanism as other air-hydraulics tables and is said to be completely positive without backlash, skips or overruns. The 15-inch diameter is ground for accuracy and may be mounted horizontally or vertically. Either a 4, 6, 8 or 12-station ring is furnished as standard equipment, but others up to 30 stations are made to order. Table operates on ordinary line pressures from 60 to 175 lb. **T-1-1293**


COBRA
MOUNTED WHEELS

There's a long life ahead for these finest imported COBRA ¼" Shank Mounted Stones—designed to do a tireless job with amazing economy. A complete range of A-Shape mounted points is available.

*Send for FREE 80-page catalog of Standard and Special Tools and sample of Cobra Mounted Point!*

UNBELIEVABLY LOW PRICED!

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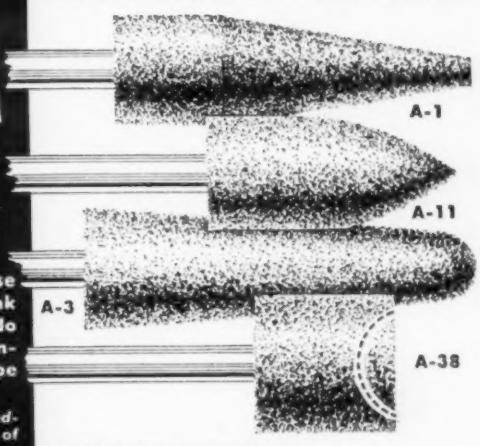


COASTAL
ABRASIVE & TOOL COMPANY
305 Canal Street, Dept. A., New York 8, N. Y.


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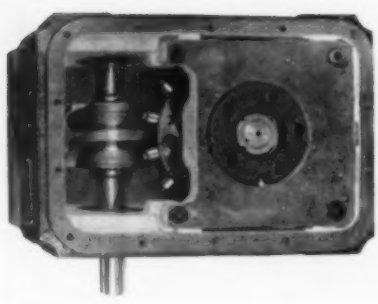
## Intermittent Drives

Solution of intermittent motion and high-speed precise indexing problems has been made as easy as the selection of a speed reducer, by the introduction of Ferguson roller gear drives, now available as completely housed units from the Roller Gear Div. of Ferguson Machine and Tool Co.

Since they are available in a wide range of standard and semistandard models for most indexing requirements, the plant engineer or machine designer selects the unit which meets his specifications, provides a mounting surface and couples the unit between the power source and the load.

These "package units" offer selective assembly for any combination of directions of rotation, and for location of



shaft extensions. Versatile mounting arrangement permits the units to be mounted in any position and fastened by any of 5 sides.

Other features include a splash lubrication system with drain level and fill plug, easy replacement of standard ball-bearing followers, complete anti-friction bearing support of shafts, rigid cast housing construction, and tapered output shafts with keyways for simple maintenance-free mounting of driven parts.

A copy of Ferguson Roller Gear Drive Catalog No. 104, which includes complete specifications and dimensions of these package units, and introduces new semi-standard drives and standard drives of larger capacities and engineering data, is available from the Division, Box 191, St. Louis 21, Mo.

**T-1-1301**

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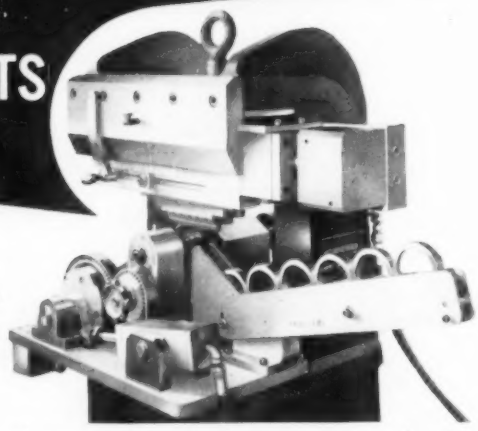
YOU CAN CUT MARKING COSTS WITH...

GTS

GEO. T. SCHMIDT

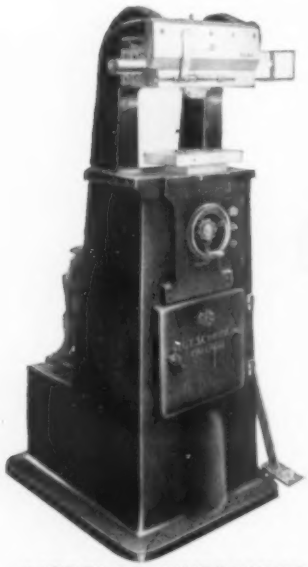
AUTOMATIC FEEDS



In many applications, thousands of components per hour are marked, with GTS automatic marking equipment. Feeding mechanisms are designed for a specific operation, custom tailored to suit your requirements.

Perhaps GTS specialists can design automatic equipment to solve your marking problems.

A trained marking engineer is at your disposal to help you modernize your marking operations and cut costs to a minimum.



MODEL 175 HYDRAULIC

GTS

The unit illustrated above marks the perifery of bearing races at the rate of 2400 to 3000 per hour. It is fed directly from automatic screw machines, and requires no operator.

*IF IT'S WORTH MAKING, IT'S WORTH MARKING.*

**GEO. T. SCHMIDT, INC.**
4104 Ravenswood Avenue
Chicago 13, Illinois

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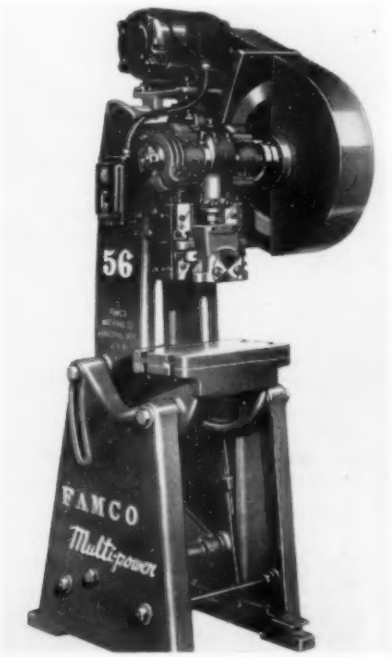
## Power Presses

By further application of the Famco Electromatic principle introduced in its 18-ton Model 59 power press, the Famco Machine Co., Kenosha, Wis., have added a new 13-ton Electromatic power press, and a second 13-ton "Multi-power" press to the line.

The same principle of instant action, electrically operated nine-point jaw clutch is incorporated in the new 13-ton Model 56-E, combining the simplicity of electric control and the high efficiency of jaw clutches. This action provides new ease in operation, and lowered maintenance costs. The 56-E is adjustable for single stroke nonrepeat, or continuous action, without stopping the press.

The second press, the Famco 13-ton



M[illegible] 56-J, is equipped with a Famco [illegible]ed multipower nine-point me[illegible]al type jaw clutch, thus making [illegible]ble two clutch types in the 13-ton [illegible]ty class.

[illegible] models are constructed of close-g[illegible]ed extra heavy cast semi-steel. T[illegible] have one-piece, heat-treated alloy [illegible]shafts, split bronze-bushed main [illegible]ngs, and greater ram area. Bal-[illegible] fly-wheels are equipped with T[illegible]ken tapered roll bearings for fric-[illegible]free power. Bijur hand or auto-[illegible] oiling systems are available and may be ordered installed at the factory or added later by the customer. Stand-ard equipment on both models includes belt and flywheel guard. **T-1-1302**

## Fabricating Compound

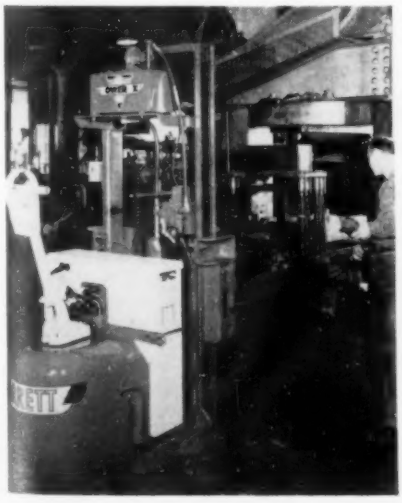
Goshen Rubber Co., Inc., Goshen, Ind., has announced a development of Buna N, which offers heat resistance of 300-325 F, good oil resistance properties and very low compression set at elevated temperatures, while remaining flexible at a temperature as low as —40 F. Other high physical properties include tensile strength of 2500 psi, elongation of 350 percent, and durometer of 70 points, making it practical for seals in transmissions, power steering and like applications. At the same time, it is suited for fabricating into any type of industrial rubber part.

**T-1-1311**

## Die Puller

A safer and less costly means of removing dies from presses is offered the die-using industries by Barrett-Cravens Co., 4609 S. Western Blvd., Chicago 9, Ill.

With the Barrett die puller, as compared to the pry bar method which requires as many as four men, one man performs the entire cycle under en-




# YOU CAN ALWAYS DEPEND ON *Steel City* TO FURNISH THE *Right* BRINELL HARDNESS TESTER FOR *Your* NEEDS

Individual requirements differ. Laboratory needs are far different from production needs. The Brinell Hardness Tester you buy must be exactly suited to your application. Our complete line of Brinell Testers includes the correct type for practically every need. Our reputation in this field since 1914 proves that if we do not have what you require, we can easily convert one of our standard models to fit your specifications. On this page are illustrations of two typical Steel City Brinell Testers. Other types available include portable, bridge type, deep-throated and long stroke designs and models to fit into your conveyor line. Write to us for a descriptive catalogue or address of our nearest sales representative.

**Dead weight type, manually operated, bench mounted Brinell Hardness Tester. Weights are linked mechanically to ball penetrator. Dash pot below weights makes load application gradual and smooth. Instantaneously select any load 500 kg. to 3000 kg. Exceptionally accurate; low maintenance. Also available as floor model and motorized.**

**Direct reading type, hydraulically operated, motor driven Brinell Hardness Testing Machine for production line testing. "Direct reading" feature eliminates time-consuming use of Brinell microscope, sometimes avoids spot-grinding. Interval timer automatically controls testing cycle. Simplified knee switch operation. Tests up to 800 pieces per hour.**

MANUFACTURERS OF MACHINES FOR TESTING PHYSICAL PROPERTIES OF METALS

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NOW
SEE
what
HORTON
CHUCK
EXTRAS
can do for you!

**SEE** the actual operation of a Horton Chuck with the new Plastic Demonstrators.

**NOTICE** the pilot hole construction of the independent chuck and the replaceable pinion bushings of the Scroll Universal Chuck — both Horton Exclusives.

**ASK** your Horton Distributor for a demonstration now. or write to . . .

HORTON
CHUCK
Windsor Locks, Conn.

INDICATE A-132

tirely safe conditions. This completely automatic electric-powered die pulling and pushing device is built directly onto the platform of the high lift electric truck shown in the illustration. The equipment includes push-button control.

The truck, which lifts, lowers and travels electrically, carries the dies to and from the die racks, and spots them in rack or press without physical effort.

The die is pulled from rack or press by means of a chain which is run through the die pullers on the truck platform and around the upright. The operator presses the button, and the die is smoothly and safely pulled onto the platform. For placing the die in press or rack the chain is removed and a bar pusher attachment is placed on the platform between the die pusher and the die itself. The operator, using push-button control, can observe the operation, as the die is pushed to the precise location desired. As a consequence, there are: savings in man-hours, greater safety, full operator observation, and handling at any level. **T-1-1312**

USE READER SERVICE CARD ON PAGE 133 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

## Hole Punching System

A multiple hole punching system with punch retainer plates for unlimited hole punching patterns has been made by the Wales-Strippit Corp., 345 Payne Ave., North Tonawanda, N. Y.

It provides a simple, fast, convenient and economical method of punching holes in sheet metal parts by permitting the entire setup to be made outside the stamping press or press brake. Punch assemblies and dies are interchangeable, permitting the same parts to be used and reused in an infinite number of setups.

The system is available two ways: (1) All individual parts are available for users to stock for assembling hole punching setups. This permits making and putting into operation a hole punching die the same day a templet is completed. (2) Wales-Strippit will build the complete hole punching assemblies ready to operate and will guarantee the accuracy of the hole locations.

Multiple hole punching boxes are available from 6x6 inches to 24x24 inches, with larger sizes made to order. Holes are located and drilled in the punch and die plates of these boxes from a master templet or pattern and may be located over the entire working area of the setup. The punch assemblies are inserted in the top plate holes and dies in the bottom plate holes.

Self-contained, the system requires no die setting skill nor any adjusting; nor aligning before or after the setups are placed on the press bed; and nothing is attached to press ram. Press "down time" consists of the few minutes required to lift one setup from the press and replace it with another. Punching starts with the first stroke of the ram. **T-1-1321**

## Lapping Machine

A bench-type lapping machine utilizing the figure 8 lapping motion has been developed by the Rhinevault Machine Co. and is distributed through Lopon, Inc., 1649 Sherwin Ave., Chicago, Ill. The 150-lb Allen Figure 8 Lapp can be mounted on any sturdy bench. It operates at four surface speeds of from 250 to 1000 ipm as the

1/3-hp driving motor connects to the mechanism by means of a V-belt and step pulleys.

Serrated or smooth 8 x 12-inch lap plates of cast iron are used and are easily interchangeable. Plates of other materials can be supplied on demand. Brackets cast in the base allow for the addition of special hold-down devices for multiple piece lapping or for the lapping of angled surfaces.

According to the maker, surface tolerances of less than 11.6 millionths of an inch are obtainable on most materials in a matter of minutes. **T-1-1322**

# THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

| LITERATURE NUMBER | COMPANY | DESCRIPTION |
|---|---|---|
| A-1-246-2 | Air-Mite | Air Press—Complete catalog describes Air-Mite Presses and air cylinders. (Page 246) |
| A-1-231 | Allegheny Ludlum Steel Corp. | Tool Steels—A new booklet gives full details on F C C air hardening, oil hardening, and other cast-to-shape tool steel specialties. (Page 231) |
| A-1-19 | The Atrax Co. | Carbide Tools—Catalog discusses the various tungsten carbide tools made by Atrax. (Page 19) |
| A-1-12 | The American Lathe Works Co. | Lathes—Bulletin 44 gives information concerning the American Pacemaker Lathe. (Page 12) |
| A-1-152 | B. C. Ames Co. | Dial Indicators—Free catalog 58 discusses a variety of dial indicator styles. (Page 152) |
| A-1-136 | F. E. Anderson Co. | Coolants—Booklet "Lusol Gets to the Point" describes what Lusol does and how it works in various types of machines. (Page 136) |
| A-1-175 | Behr-Manning Corp. | Belt Polishing—Data on new belt methods are discussed in booklet, "How Polisher Pete Put Economy in Polishing." (Page 175) |
| A-1-207 | The Bellows Co. | Air Power Devices—Bulletin EL-50 describes air power devices such as drill press feeds, rotary feed tables, and arbor presses. (Page 207) |
| A-1-24 | Besly-Welles Corp. | Taps—"Handbook for Users of Taps" informs readers of up-to-date tapping methods and selection. (Page 24) |
| A-1-117 | H. E. Dickerman Mfg. Co. | Feed Devices—Literature and catalogs discuss features on the complete line of die feeds. (Page 117) |
| A-1-143-2 | The du Mont Corp. | Tool Bits—Free comparison chart and price list C-1 gives all standard sizes of square and rectangular high-speed tool bits. (Page 143) |
| A-1-153 | A. B. Farquhar Div., Oliver Corp. | Hydraulic Presses—Catalog discusses features and applications of Farquhar presses. (Page 153) |
| A-1-232 | Gisholt Machine Co. | Balancing Machines—Machines for static and dynamic balancing of parts are discussed in catalog. (Page 232) |
| A-1-170-1 | The J. C. Glenzer Co., Inc. | Utility Tools—Folders 1-A, 1-J, and 1-D describe sleeves, tool holders and live centers respectively. (Page 170) |
| A-1-140 | Guthery Machine Tool Corp. | Screw Machines—New 32-page catalog discusses single spindle automatic screw machines, turning and copying automatics and chip separating machines. (Page 140) |
| A-1-125 | Hammond Machinery Builders | Dust Collectors—Catalog C-75 gives benefits derived from "Dustkolectors." (Page 125) |
| A-1-252-1 | Hapman Conveyors, Inc. | Tubular Conveyors—Bulletin TE-154 tells advantages of tubular type conveyors. (Page 252) |
| A-1-170-2 | Heinrich Tools, Inc. | Tools—Catalog describes features of drill press vises, fixtures locks, nibblers, punches, and rod cutters. (Page 170) |
| A-1-120 | The Hisey-Wolf Machine Co. | Grinders—Catalog 72 E K describes ranges, sizes, and types of Hisey grinders. (Page 120) |
| A-1-179 | The Hydraulic Press Mfg. Co. | Power Units—Facts on pumps, motors, power units, and accessories are given in catalog 601. (Page 179) |
| A-1-238-1 | Industrial Diamond Association of America, Inc. | Diamonds—Booklet, "The Diamond That Pays for Itself" gives detailed facts about industrial diamonds. (Page 238) |

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| A-1-183 | The Ingersoll Milling Machine Co. | **Cutter Grinders**—New cutter grinding manual 62-F discusses advantages derived from Ingersoll cutter grinders. (Page 183) |
| A-1-128 | The B. Jahn Mfg. Co. | **Dies**—Booklet gives picture story of various jobs and economies derived from Jahn dies. (Page 128) |
| A-1-189 | Jones & Lamson Machine Co. | **Die Heads**—Illustrated catalog 504, "Holders for J. & L. Die Heads," describes the features of different types of heads. |
| A-1-191 | Kearney & Trecker Corp. | **Special Machinery**—Booklet "Doorway" describes the facilities of the special machinery division. Data sheet 1002 gives details on 6-spindle transfer type mill. (Page 191) |
| A-1-34 | Kling Bros. Engineering Works | **Friction Saws**—Twelve-page bulletin 9200 gives detailed explanation of the economies of time and money derived from friction saws. (Page 34) |
| A-1-21 | Lapointe Machine Tool Co. | **Broaching Machines**—Catalog 5 discusses the types and sizes of Lapointe broaches. (Page 21) |
| A-1-216 | Lindberg Engineering Co. | **Induction Heating Units**—Bulletin 1440 explains ways of effecting savings and shows applications of induction units. (Page 216) |
| A-1-235 | Lodding, Inc. | **Jig and Fixture Components**—Booklet includes full scale layouts of every Lodding fixture. (Page 235) |
| A-1-171 | Miller Motor Co. | **Air and Hydraulic Cylinders**—Bulletins A-105 and A-104 discuss features of both air and hydraulic cylinders. (Page 171) |
| A-1-250-4 | The Maxwell Co. | **Internal Forming Tool**—Catalog D B points out advantages and economies derived from the Maxwell "Recess-O-Matic." (Page 250) |
| A-1-210 | Mercury Engineering Corp. | **Grinders**—Bulletin F-739 discusses features, advantages, and applications of Mercury grinders. (Page 210) |
| A-1-157 | Oakite Products, Inc. | **Cleaning Materials**—Booklet covers such subjects as tank and machine cleaning, burnishing, paint stripping, and rust prevention. (Page 157) |
| A-1-138 | Nelco Tool Co., Inc. | **Carbide Tools**—Forty-eight page catalog gives listings and prices of Nelco tools. (Page 138) |
| A-1-201 | Raybestos-Manhattan, Inc. | **Centerless Grinding Wheels**—Bulletin 6952 gives details of Manhattan wheels. (Page 201) |
| A-1-239 | Rivett Lathe & Grinder, Inc. | **Hydraulic Power Units**—Catalog discusses specifications and describes Rivett hydraulic power units. (Page 239) |
| A-1-144 | Sheldon Machine Co., Inc. | **Lathes**—Manual names, numbers and positions, parts and sub-assemblies in exploded drawings. (Page 144) |
| A-1-139 | Skinner Chuck Co. | **Chucks**—Catalog gives complete details on Skinner line of power and manually operated chucks. (Page 139) |
| A-1-143-1 | Sorenson Center-Mikes, Inc. | **Center-Mikes**—Bulletin 652 points out advantages and economies derived from center-mikes. (Page 143) |
| A-1-202-2 | P. A. Sturtevant Co. | **Torque Wrenches**—"Sturtevant Torque Manual" gives various data on torque wrenches. (Page 202) |
| A-1-215 | Sundstrand Machine Tool Co. | **Mills**—Bulletin 739 supplies complete specifications for Sundstrand "Rigid-mils." (Page 215) |
| A-1-193 | Swartz Tool Products | **Fixtures**—new catalog 953 illustrates the line of Swartz fixtures. (Page 193) |
| A-1-165 | Vanadium-Alloys Steel Co. | **Hot Work Die Steels**—Booklet "Die Steels for Hot Work" gives details and advantages. (Page 165) |
| A-1-209 | Waldes-Kohinoor, Inc. | **Grooving Tools**—Twenty-page technical manual contains full engineering data. (Page 209) |
| A-1-233 | Zagar Tool, Inc. | **Drill Heads**—Catalog E-1 states advantages of Zagar multiple drill heads. (Page 233) |

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# Technical Shorts...

### Powdered Iron Production

A PATENTED PROCESS for the production of powdered iron has been perfected by Republic Steel Corporation, who will utilize it for the commercial production of iron powder in a new plant under construction in Toledo, Ohio. The process came as a result of continuing study being carried out concerning direct reduction of iron ore to high purity iron.

Conventional steelmaking, as opposed to the direct reduction method, utilizes a dual process—first, smelting of the ore to a form of iron in a blast furnace, and second, converting this iron to steel. To date, no direct reduction process has been developed in the United States which has been practical economically. However the initial cost of conventional blast furnace for steelmaking facilities has been sufficient to keep the search for a direct method going.

In 1948 and years following, Republic, with Henry L. Crowley Co., Inc. of West Orange, N. J., worked on an intensified research program on the problem of producing iron from ore by direct reduction methods. Eventually it was possible to produce substantial amounts of very pure iron powder consistently from either low or high grade ores, though economically it still was not competitive with conventional processes. However, from this experience information was gained which finally resulted in the perfected process, which will be utilized in commercial production.

Thus Republic becomes the first of the nation's major steel companies to set up for iron powder on a commercial scale. In building the Toledo plant, with a 50,000 pounds per day capacity, a substantial part of the nation's present market will be provided. The completion date for this unit is expected sometime in the summer of 1954.

Republic also proposes to make iron powder for application in the field of flame scarfing and cutting where substantial quantities are used to intensify the heat of the flame. The company, in fact, has extensive use of this in its own steel plants.

Also by a variation of the process, consideration is being given to the production of sponge iron which might be used to produce tool steel and similar high grade steels. Experiments show still further that there is a possibility of producing nickel and manganese from low grade ores.

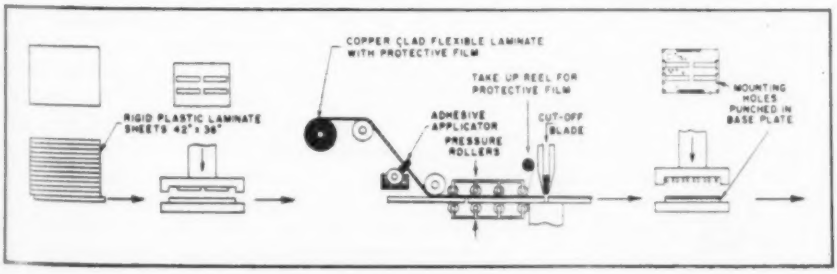
* * * * *

### Experimenting With Automatic Production Line

EXPERIMENTATION which has been carried on for the past three years by Stanford Research Institute has included work with an automatic production line of its own design. Results have brought about some concrete facts which may be considered when industry now talks about the automatic factory. Primarily, the Institute's findings show that a system using functional, interchangeable units will be most flexible and economical and simplify line changes new models.

In the experimental line, an etched circuit on a flat plane replaces complicated hand wiring. A chemical-resistant coating is automatically sprayed through a stencil or printed through a screen onto a foil-covered base plate. Immersing the plate in an acid bath eats away the unprotected metal, leaving the circuit pattern intact. As de-

**Approach to automatic production line for trial assembly shows punch press located at left, laminator in the center and punch press at right.**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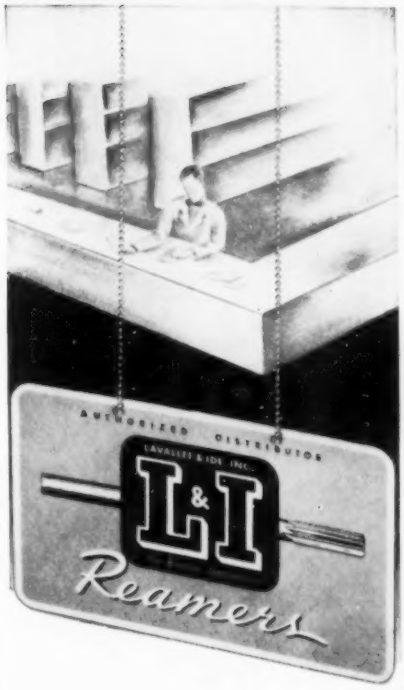


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signed by engineers of the Institute's Advanced Techniques Laboratory, the automatic production line could turn out approximately ten five-tube electronic subassemblies per minute. The etching time has been lowered by the improvements of the technique to 30 seconds as compared with anywhere from three to eleven minutes required formerly.

As a result of their research, SRI engineers made several observations bearing on the eventual automatic factory—prime point being that the end product must be designed to fit the fabrication method.

The work was undertaken by SRI for the U. S. Air Force which guards against the fact that hand-assembly methods could not produce enough electronic equipment for an all-out emergency. Further, last year's peace time demands by military, industrial and home users increased 50 percent over peak wartime production. At such an output, the automatic production line could improve quality control and reliability, minimize waste and bring manpower costs down, the engineers declare.

* * *

**Plastic Sheet For Casting**

INTEGRATION of styrene and rubber into a new kind of rigid plastic sheet material, with unusual properties and excellent low-cost forming characteristics, has been announced by the Campco Div., Chicago Molded Products Corp., 2717 N. Normandy Ave., Chicago. The material, called Campco S-300, is a copolymer of polystyrene and rubber extruded through specially designed continuous equipment to produce, in a single operation, a material having a smooth surface and a high gloss finish. Any desired length in widths ranging from 26 to 58 inches may be supplied in thicknesses ranging from 0.005 to 0.125 inch. Color range appears unlimited.

The resultant sheet seems to have a number of favorable qualities; it has a high impact strength without sacrifice of formability. In addition, the sheet machines easily, and is dimensionally stable since its water absorption is low. Forming is simple; no heavy presses, machines, or expensive dies are required. Low-cost wooden, sprayed metal, or reinforced plaster dies give optimum results. The sheet is usually heated to a predetermined temperature, then snapped into final shape by applying vacuum through a low-cost die. It is reported that even the minutest detail in the mold can be reproduced.

Further, the process lends itself well

to mechanization; in many applications it can compete volume and cost wise with injection molded shapes. Although vacuum-forming is one of the newest and most promising of plastics developments in the last few years, its real industrial utilization has been somewhat delayed. Up to now, problems of sheet cost, sheet finish, speed of forming, and the like have retarded the use of formed sheet plastic by many manufacturers.

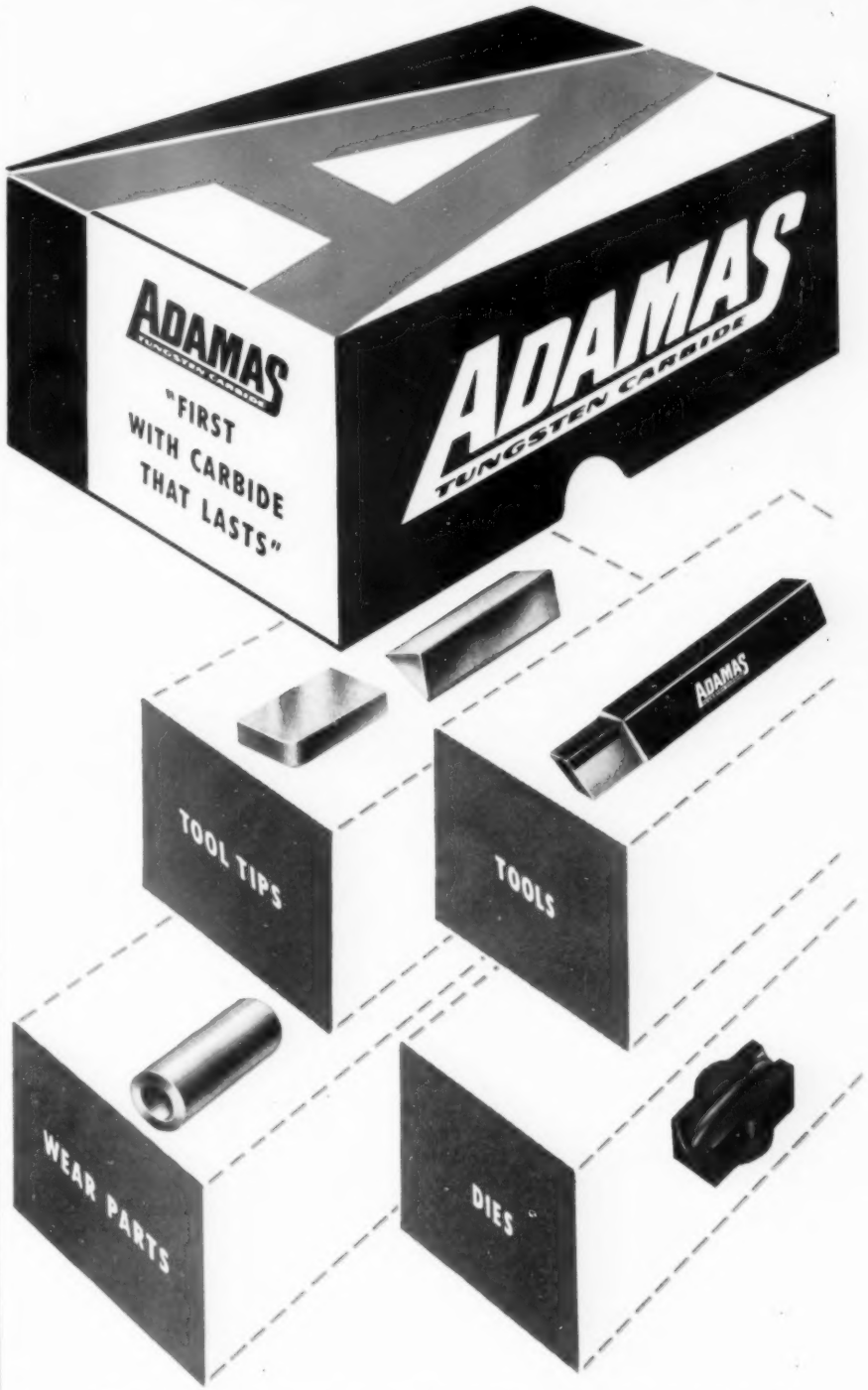
According to Edward Bachner, vice president in charge of the Division, Campco S-300 can compete in many applications with conventional sheet steel, aluminum, wood, paperboard, fiberboard, glass, injection-molded plastics, and can even replace fabric in applications where the fabric serves as a liner, as in car-roof interiors, for example. Its use would, of course be governed by sound engineering and production reasons: it could only serve light structural purposes, yet for formed parts like door liners, it could easily justify its selection because of its built-in glossy finish and color, insulating value, high impact strength, ease of cleaning and handling, plus its obvious production advantages.

### Represents Economy

Actually some manufacturers have found that prototypes can now be produced in weeks instead of months without substantial die and machine investment. Model changes are simplified since dies are easy to modify or replace. Speed of manufacture also interests high-production industries: the interior liner of a refrigerator door can be converted from flat sheet to finished, ready-to-install part in less than a minute.

Plastic sheet is not new in the plastics industry. Cellulose acetate, cellulose-acetate butyrate, ethyl cellulose, and rigid vinyl have been available in extruded form for some time. The polystyrene 'alloys" compounded with rubber are a new entry, and Campco's production capacity of 500,000 lb per month makes it the largest potential supplier in the field. Display and packaging items have been formed of the cellulose and vinyl materials for a number of years, but the big lift in formed sheet products has awaited the styrene copolymer sheet-and-vacuum forming combination.

Compared with its plastic competitors, Campco S-300 is believed to have higher impact strength than rigid vinyl, has a higher heat distortion temperature, is lighter in weight per unit area, and costs less. To get a comparable gloss on rigid vinyl requires a second operation which has to be reflected in sheet cost. However, rigid vinyl is self-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**Properties of Campco S-30**

| | |
|---|---|
| Tensile strength, psi | 4,000 - ,000 |
| Elongation percent | 22 - |
| Modulus in tension x10⁵ psi | 3.3 - |
| Impact strength Izod notched | 1.5 - |
| Izod unnotched | 11 - |
| Flexural strength | no fa |
| Heat distortion deg F | 155 - |
| Flammability in./min. | 1.2 |
| Rockwell hardness | M30 - |
| Specific gravity | 1.04 - |
| Thermal coeff. expansion in./in./deg C | 6.5-8.5 x |
| Yield point psi | 26,0 |

(These properties are for the raw material; sheet properties may vary slightly.)

extinguishing and has higher tensile strength.

Comparing its performance to that of the cellulosic materials, Campco S-300 has a higher heat-distortion point, and is not so flammable. Its water absorption characteristics are much lower, suggesting better dimensional stability. Impact strength of standard Campco sheet is higher than that of competing cellulose sheet, although special cellulosic sheeting can be obtained with excellent impact characteristics.

First large-scale applications will be found in new model refrigerators now under development. Here Campco will serve as door liners, drip pans, crisping chests, meat-keepers, etc.

The Campco Div. of Chicago Molded Products Corp. represents a $500,000 investment by the parent company in the future of extruded copolymer sheet. The firm has announced its intention to work with other types of extrudable plastics to produce sheets with special forming properties. The plant will be able to produce sheet of any type, in any width or length, and where required to exact special thicknesses. Meanwhile, plans are being made to warehouse standard sizes and colors of the S-300 sheet throughout the country, much as sheet steel is warehoused.

* * *

**Detecting Heat Changes**

OBJECTIVES AND the philosophy of the voluntary standards movements in this country are discussed in a 24-page booklet issued by the American Standards Association. The group emphasizes the economic importance of standardization in "Standards Are Your Business" as it defines standards of production and their value as tools of management. It not only includes a section on Federal Government policy toward industry standards but also specific examples of recent savings through their incorporation by numerous U. S. firms.

The booklets are available from ASA, 70 E. 45th St., New York 17, N.Y.

# good reading

**FABRICATED MATERIALS AND PARTS** *by T. C. DuMond. Published by Reinhold Publishing Corp., 330 W. 42nd St., New York 36, N. Y. Price $6.50. 332 pp.*

This book, written in a direct style, describes 20 methods of making small parts. Fully discussed are such subjects as costs, materials used, advantages, limitations, design factors, and the sizes and tolerances possible with each of these methods.

The author has directed the material to manufacturers who know what their products must do, and enables him to find out quickly what factors are involved in choosing the soundest, most economical method of manufacture.

Of specific interest to the non-specialist are the introductory chapters which discuss the relationships between all the major production factors which are part of a practicable decision.

**ELEMENTS OF HEAT TREATMENT** *by George M. Enos and William E. Fontaine. Published by John Wiley and Sons, Inc., New York, N. Y. Price $5.00. 286 pp.*

Fully illustrated, this book provides a thorough grounding in the basic principles governing the application of heat to alter the mechanical properties of metal.

The authors define the major heat treatment processes—annealing, hardening, tempering, and normalizing—and show how each is used to get the metal characteristics needed for a specific job. Casting, forging, rolling, welding, machining, and other processes related directly or indirectly to heat treatment are briefly discussed.

**FERROUS ANALYSIS** *by E. C. Pigott. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Price $12.50. 690 pp.*

A thorough treatment is given in this book to ferrous analysis of metals. The author has given complete treatment to the choice of available techniques for photoelectric absorptionmetry, spectrographic procedure and organic reagents for the quantitative analysis of iron and steel.

Also covered are micro-chemical analysis of iron and steel, alloys and ores, refractory materials and a glossary of chemical, physical and metallurgical terms.


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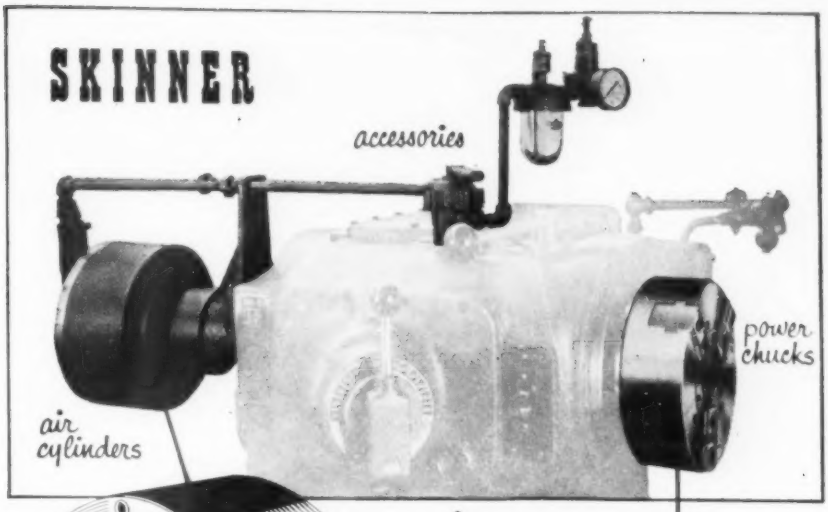


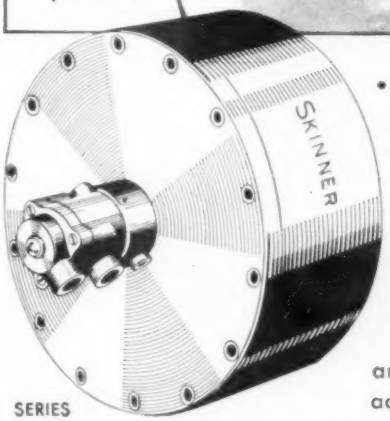


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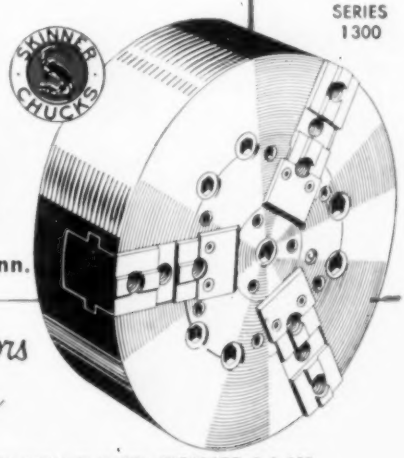


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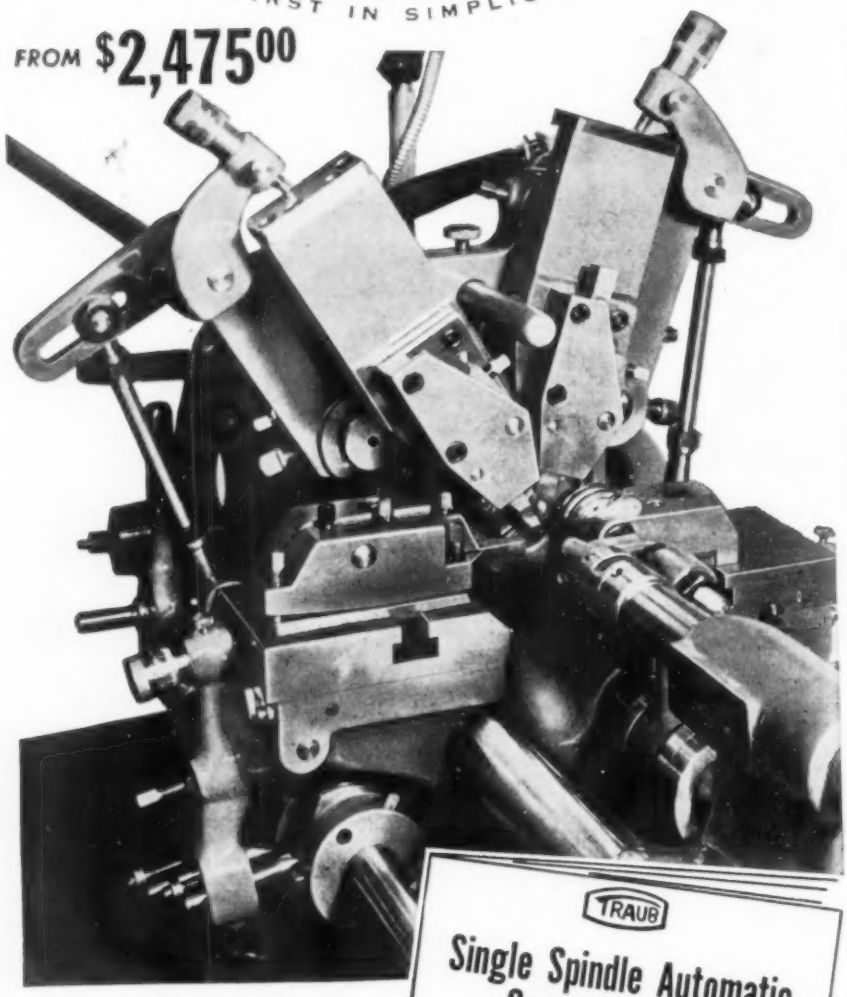

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## Who's Meeting - and Where

**Jan. 11-15.** SOCIETY OF AUTOMOTIVE ENGINEERS. Annual meeting. Sheraton Cadillac Hotel and Hotel Statler, Detroit, Mich. Write the society headquarters, 29 W. 39th St., New York 18, N. Y., for full information.

**Jan. 22.** MALLEABLE FOUNDERS' SOCIETY. General meeting. Hotel Cleveland, in Cleveland. The society office, 1800 Union Commerce Bldg., Cleveland 14, Ohio can provide details.

**Jan. 25-28.** PLANT MAINTENANCE & ENGINEERING SHOW. International Amphitheatre, Chicago. For full information write to Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

**Jan. 30.** AMERICAN SOCIETY FOR QUALITY CONTROL. Cincinnati Regional conference. Cincinnati Bldg., Cincinnati, Ohio. For details, contact society office, 70 E. 45th St., New York 17, N. Y.

**Feb. 3-5.** SOCIETY OF THE PLASTICS INDUSTRY, INC. Ninth annual conference, reinforced plastics division. Edgewater Beach Hotel, Chicago. Complete details may be had from the society, 67 W. 44th St., New York 36, N. Y.

**Feb. 5-6.** AMERICAN SOCIETY FOR QUALITY CONTROL. Middle-Atlantic regional conference, Lord Baltimore, Baltimore, Md. Write to the society, 70 E. 45th St., New York 17, N. Y. for more information.

**Apr. 26-30.** AMERICAN SOCIETY OF TOOL ENGINEERS. Tool Engineers' Industrial Exposition. Convention Hall, Philadelphia, Pa. to be held concurrently with annual meeting, Benjamin Franklin and Bellevue Stratford Hotels.

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**National offices** of the American Society of Lubrication Engineers have been moved to the Western Society of Engineers Bldg., 84 E. Randolph St., Chicago 1, Ill.

**Jerry Singleton** is the new executive secretary of The Magnesium Association, effective January 1, according to an announcement by James Kirkpatrick, president of the organization. For the past three years, Mr. Singleton held a comparable position with the Advertising Typographers Association.

**Installation of** Marshall Holt as national president of the Society for Experimental Stress Analysis took place at the organization's annual meeting in December. Dr. Holt is associated with Aluminum Co. of America.

# HOW TO USE TRACER CONTROLS

By George L. Rogers
Specialty Control Department
and
John L. Dutcher
Industrial Engineering Section
General Electric Co.
Schenectady, N.Y.

A TRACER-CONTROLLED MACHINE is different from the usual machine tool in two basic respects. First, it is operated in a different manner and therefore various operating features are required which are not needed on standard machines. Provisions for efficient setup of tracing head, templet, and work must be made so that the time saved in machining is not lost during setup operations.

Secondly, a different concept of machine mechanical design is required. Machine deficiencies such as vibration, stickiness, and backlash produce different effects when a machine is tracer-controlled than they do when it is under the control of an operator. While the tracer can compensate for these deficiencies under many conditions, it may tend to exaggerate their effects under others.

The two principal types of tracer systems are: single-dimension, most commonly used on lathes; and two-dimension, used principally on milling machines for 360-degree profiling. The family of tracer systems is rounded out by selective two-dimension tracers used for dies sinking or similar machining operations. Simultaneous three-dimension tracing may also be accomplished by combining a two-dimension and a single-dimension system and using either two tracing heads and two templets or a single combined tracing head with a three-dimensional templet.

All tracers, hydraulic, pneumatic, mechanical or electric, are made up of essentially the same parts in one form or another. Each tracer includes a sensing element which feels the surface of the templet and provides a form of intelligence to the tracer. It includes amplifying elements which amplify and generally modify this intelligence to make it useful in controlling drive elements which power the machine feeds. Also a real part of the tracer system is the mechanical gearing or linkages which transmit power from the drive elements to the linear motion of the machine feeds. Generally one form or another of stabilizing means will be used to damp out oscillations or overcorrections which may tend to creep into the system.

## Single Dimension Tracer

Single-dimension tracers are most commonly used on lathes but also find use on boring mills and some milling machines. The position of only a single machine motion is controlled by the tracer while a second feed is driven at a constant rate by some other means.

Such a system applied to a lathe is shown in *Fig.* 1. It will be noted that in this case, the tracer-controlled feed is at forty-five degrees to the machine axis to aid in turning shoulders. The carriage feed is driven at a constant rate, or in some cases is slowed down, when a sharp shoulder is reached but is independently controlled. The unique feature of single-dimension system is that there is a velocity error which is proportional to the rate of motion of the tracer-controlled feed. This error can be made extremely small but is always present.

## Two-Dimension Tracer

Although several parts of the two-dimension or profiling tracer have a considerable resemblance to corresponding parts in the single-dimension system, the basic principle of operation is entirely different. In this case, two machine feeds at right angles to each other are controlled and the deflection of the tracing head stylus literally steers the tracer around the templet at a constant speed. This two-dimension system has been used on boring mills and essentially all types of milling machines.

The general arrangement of the tracing head, electronic control, amplidynes, motors, and machine gearing appears in *Fig.* 2. The speeds of the motors are proportional to the d-c volt-

**Fig. 1. Single dimension tracer system for a lathe.**

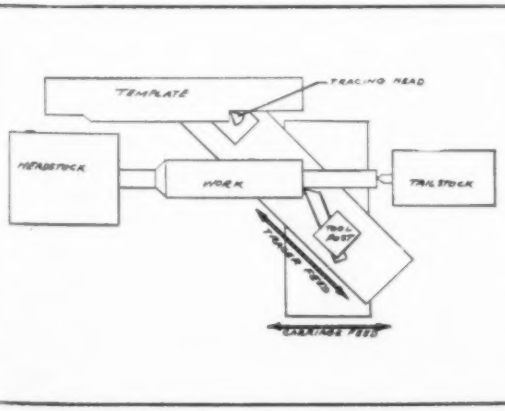
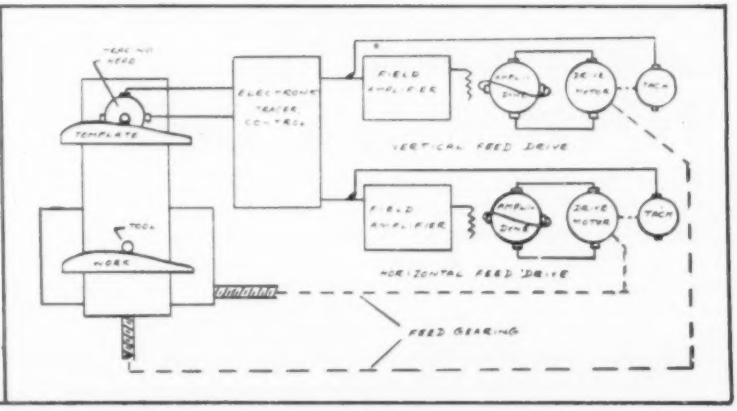



**Fig. 2. Electric two-dimension tracer for boring or milling machine.**



ages which are the inputs to these drives.

Since the tracing head is sensitive to deflections in all directions and the amplidyne feed drives are completely reversing, this tracer will profile through 360 deg. without attention.

Everything possible is done to the electric system to compensate for both its own deficiencies and those of the machine. However, since compensation can never be complete, it is essential that machine deficiencies be eliminated or reduced to the absolute minimum. These deficiencies are:

1. Backlash in the feed drive.
2. Windup in the various parts of the feed drive system.
3. Stickiness of the machine ways.
4. Vibration.
5. Deflection of the machine members.
6. Misalignment of the tracing head.

### High-Speed Milling

At the upper extreme of the range of tracing feed speeds, which have been observed, is a small milling machine capable of machining at feed rates up to 100 inches per minute. The limiting factor is the machine backlash.

### Low Speed Milling

At the extreme low end of the range of feed speeds are the large boring mills used for difficult machining of materials such as stainless steel.

Presented at the 1953 Annual A.I.E.E. Conference on Machine Tools.

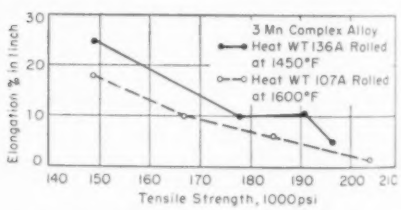
▼ ▼ ▼

## Heat Treatment of High Strength, Titanium-Base Alloys

*by W. M. Parris, P. D. Frost and J. H. Jackson*
*Battelle Memorial Inst.*

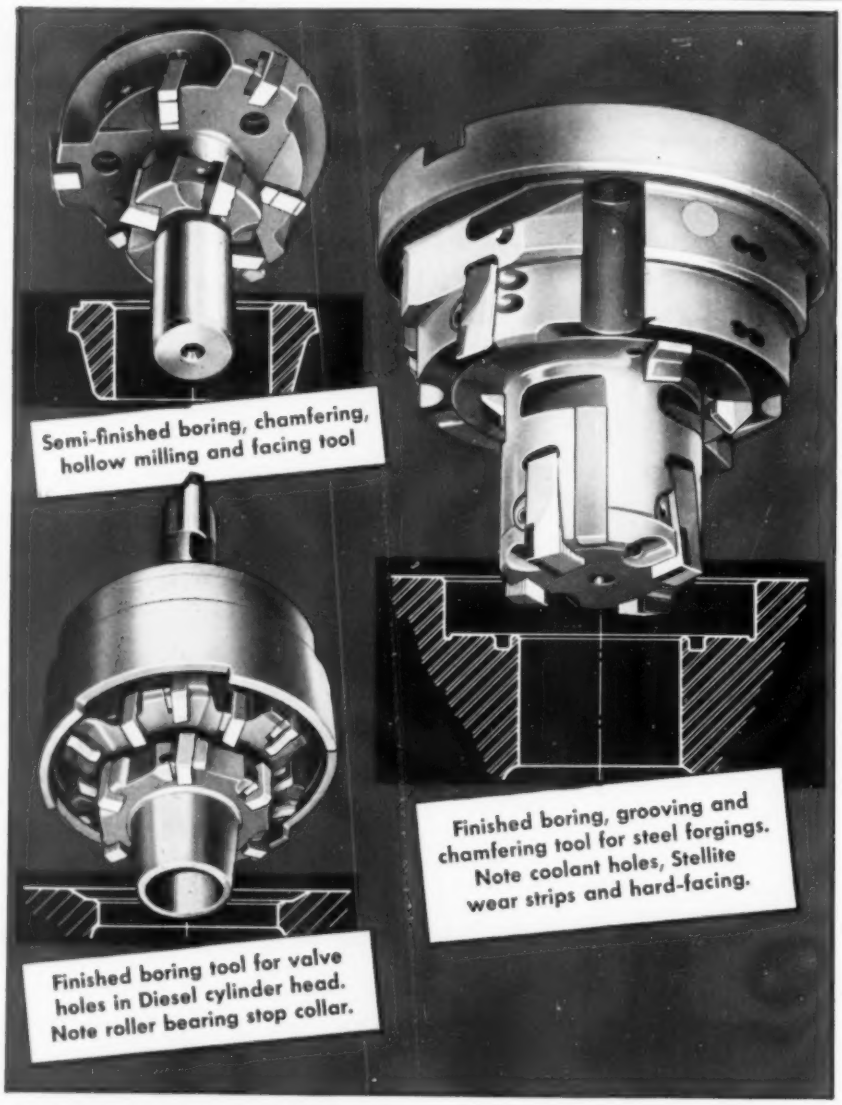
The properties of heat treated titanium alloys were found to depend upon (a) composition, (b) type of heat treatment, and (c) fabrication history. Alloys rolled at temperatures in the alpha-beta or beta regions and subsequently solution-treated in the alpha-beta field had good tensile properties in the quenched and air-cooled conditions. However, specimens rolled and solution-treated in the alpha-beta temperature range and then overaged at 800 to 1100 F had much better properties. The overaged specimens were also stable upon reheating at 500 F for periods of 500 to 1000 hours. Solution treatment in the beta field severely embrittled all alloys, even when they were overaged to low hardness levels. One of three alloys rolled in the beta field had fairly good ductility after solution and overaging treatments.

The effects of various types of heat treatments on the tensile properties and hardness of three experimental high strength titanium alloys were studied. The effect of hot rolling temperatures




in the alpha-beta and beta-phase regions on properties after subsequent heat treatment was also investigated.

The effect of solution treating, i.e., heating in the alpha-beta or beta-phase regions and cooling at relatively fast rates, was found to vary with alloy composition, solution temperature, cooling rate, and, to some extent, rolling temperature. Tensile strengths of 140,000 to 170,000 psi in sheet and 140,000 to


Semi-finished boring, chamfering, hollow milling and facing tool
Finished boring, grooving and chamfering tool for steel forgings. Note coolant holes, Stellite wear strips and hard-facing.
Finished boring tool for valve holes in Diesel cylinder head. Note roller bearing stop collar.

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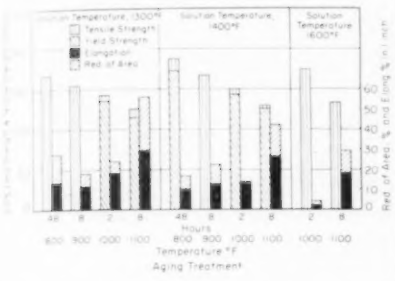
1[illegible]00 psi in bar stock with good ductil[illegible] at all strength levels were produced by such treatments.

[illegible]e hardening of solution-treated alloys at temperatures up to 700 F (2[illegible] C) generally resulted in high strength and low ductility. Overaging at [illegible]00 to 1100 F (425 to 595 C) of alloys rolled to bar stock and solution-treated in the alpha-beta phase region produced excellent properties over a



wide strength range. Strengths of over 200,000 psi with elongations of 10 percent in 1 inch or more were achieved. Overaging of the heats rolled in the beta-phase region resulted in very low ductility in two of the three alloys. In all cases, solution treatment in the beta region prior to aging produced very brittle materials.

Overaging also produced good elevated-temperature stability. The properties of two of the three alloys, heat treated to about 200,000 psi tensile strength, were essentially unchanged after 1000 hours at 500 F (260 C). The third alloy heat treated to 214,000-psi ultimate strength was stable up to at least 500 hours at 500 F (260 C).

From a paper presented at the 1953 *American Society for Metals* Annual Convention, Cleveland, Ohio.

▼ ▼ ▼

## Nuclear Power Plants

*by R. A. Bowman, Mgr.*
*Engineering,*
*Beclitel Corp., Power Division,*
*San Francisco, Calif.*

As a result of concentrated efforts, real progress has been made toward the development of power plants producing power from the heat of nuclear fission. A submarine using this power is now being built. Work is also going forward successfully on a second submarine power plant using a different basic reactor type. The experimental Breeder Reactor at Arco has gone into operation and is pro-

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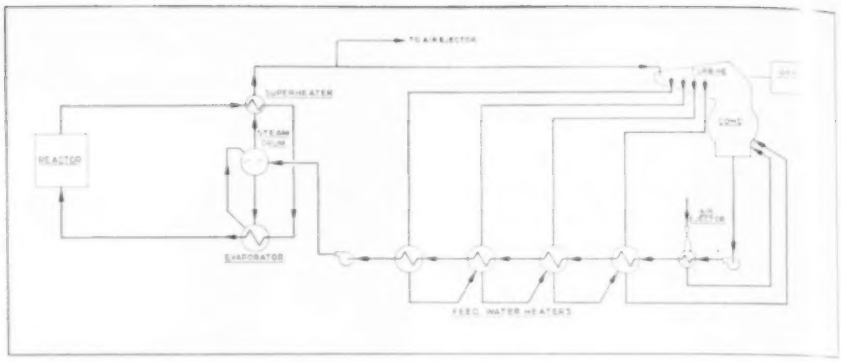
with token amounts of electric power.

The external appearance of a nuclear power plant will probably be much like a conventional coal or oil fired plant except that the boiler will be replaced by a building containing the reactor and steam generator. It will be a clean looking plant with no coal or oil storage facilities.

The reactor itself will be located in the square space at the center of the building and is surrounded with concrete shilding about ten feet thick. Auxiliary equipment such as pumps and heat exchangers is shielded by concrete walls of a lesser thickness.




**Basic flow diagram of nuclear generator resembles steam power plant.**

The plant is divided into steam producing and steam using areas as is common with fuel fired plants. The control room is placed between these areas. The turbine may be located either indoors or outdoors but since concrete walls are required for shielding in the reactor area it is only natural that these walls will be utilized also as reactor building walls.

The provision of a stack in a non-fuel burning plant may appear superfluous at first glance but it serves as a convenient way of disposing of gases that might contain moderate amounts of radioactivity. Discharging gages well above the ground causes them to become diluted to safe tolerance before reaching inhabited areas. Ventilating air will normally be continuously discharged to this stack as a precautionary measure.

There is reason to expect that the basic flow diagrams will be about as shown above and will resemble that of a conventional steam power plant. The heat produced by nuclear fission in the reactor is absorbed by the coolant circulating through the reactor and is then transferred to boiling water to produce steam in the steam generator. The steam is then used in a standard turbine heat cycle.

The opinion is unanimous that while such a plant could be designed and built at the present time the cost would be too high for the plant to compete economically with our conventional plants. This high cost is due to the probable short life of the early reactors, the health and safety considerations that must be built into them and the lack of mass manufacturing techniques.

As familiarity is gained with this type of reactor through the design and operation of several plants, the cost will undoubtedly be reduced. Whether this reduction will be enough to establish the nuclear plant as an economical power producer is beyond

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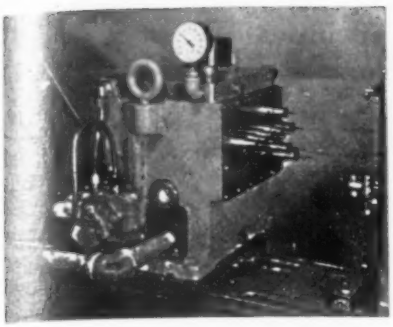

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anyone's ability to predict with certainty. The only way to find out is to build one or more such power plants and then to take another look at what the cost promises to be. The incentive furnished by the almost unlimited energy resources that will be available to the nuclear power plant makes it seem certain that these plants will be built and that a way will be found to reduce the costs to a reasonable figure.

From a paper presented at the ASME Semi-Annual Meeting, Los Angeles, Calif., 1953.

▼ ▼ ▼

### Preventive Maintenance Cuts Upkeep

*by W. A. Black*
*Chief Electrical Engineer*
*Steel and Tube Div.,*
*Republic Steel Corp.*

With a substantial portion of their sales dollars required to pay for the upkeep of plants and equipment, many companies could turn more dollars to the profit side of the ledger through improved preventive maintenance.

Ultrasonic testing of a large crankshaft recently saved a large steel plant from the impending failure of a machinery part that could have been disastrous to life, property and production.

By means of an ultrasonic testing set, growing cracks were found in the crankshaft of a 25,000 horsepower blooming mill engine. These cracks were located where they were invisible to the eye of an inspector, even if the 126-ton part had been removed.

With the aid of the electronic device, a block of steel, even of the size of this shaft, becomes almost as transparent as glass. A crystal connected with the testing device projects a mechanical vibration into the piece of steel in question. A wave travels through the metal and is reflected from the opposite end. The projected and reflected waves are pictured on a screen. A flaw in the metal is revealed as a distortion of the wave. This is the modern version of the ancient practice of striking a piece of metal with a hammer and judging its soundness by the ring. The ultrasonic tester is capable of searching through 80 feet or more of solid steel to detect a hidden crack.

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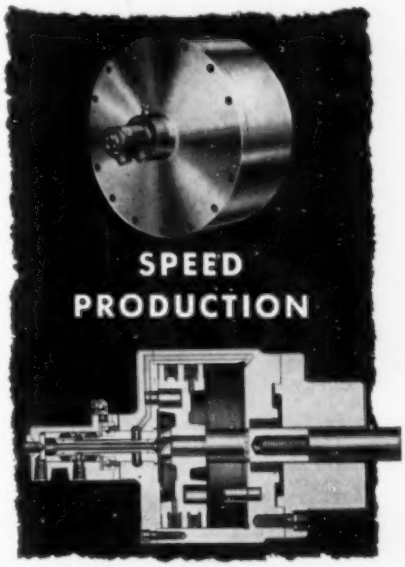


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highlighted by the necessity of maintaining maximum production. Visual inspection revealed nothing wrong but as a final check the ultrasonic device was used and revealed the danger. After five days the cracks appeared to have grown so that a shutdown was judged necessary to prevent an accident. With an orderly shutdown, the shaft was replaced in two days.

From a paper presented at the Sixty-first General Meeting of American Iron and Steel Institute in New York, 1953.

▼ ▼ ▼

## Brazing Titanium

*by N. A. De Cecco*
*Armour Research Foundation*

Methods have been developed for brazing commercially pure titanium with an oxyacetylene torch, by electric resistance heating and in a furnace using an inert gas atmosphere of commercial purity. Torch heated single lap joints had a high shear strength when tested in tension. Joints brazed with fine silver broke with a ductile shear fracture whereas joints made with other braze metals broke with a brittle shear fracture. Resistance heated lap joints were made with sufficient strength to break the titanium in tension outside the lap area.

The surface films which form on heating, were studied by reflected electron-diffraction techniques. Fluxes were developed for removing these surface films; they incorporated metal depositing reagents such as AgCl, $Cu_2Cl_2$ and $MnCl_2$. When fused on a titanium surface, these fluxes react with the titanium and undercut the oxide surface, depositing a protecting metal film in a chemical replacement type of reaction.

An approximate titanium-silver phase diagram was constructed; it provided a metallurgical understanding of metallographic structure of joints brazed with fine silver and verified the existence and ductility of the intermetallic compound TiAg, which was discovered in the course of this investigation.

An exploratory investigation for welding commercially pure titanium and a 7 percent manganese-titanium base alloy by recrystallization welding produced joints with shear strengths equivalent to the shear strength of the annealed titanium base metal.

From a paper presented at the American Welding Society 1953 National Spring Meeting.

# TRADE LITERATURE

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### Lubrication

Stuart's "Shop Notebook" presents great deal of useful information on machine tool lubrication, cutting fluids, for many applications and oils for various uses. Widely illustrated with drawings and diagrams as well as photos; explains performance, advantages and applications, and outlines recommendations for each instance. D. A. Stuart Oil Co., Ltd., 2727 South Troy St., Chicago 23, Ill. **L-1-1**

### Heating Elements

"Hot Rod" Crystolon heating elements described in illustrated instructional manual No. 146; covers expected service life, operating temperatures, mounting methods, power consumption and electrical data, specifications, operating suggestions and accessories. Charts, tables and photographs help emphasize various points. Norton Co., Worcester 6, Mass. **L-1-2**

### Engraving

Twenty-four page catalog describes industrial application of tracer guided engraving machines; covers engravings of plastics, metal, glass and wood, illustrating methods of calibrating, profiling and slotting. Machines are shown in on-the-job sequences to give better conception of performance. New Hermes Engraving Corp., 13-19 University Place, New York 13, N.Y. **L-1-3**

### Wire Punches

Folder gives data on high-speed steel punches for close tolerance small diameter holes closely spaced; includes specifications, dimensions price and order information for standard sizes. Dayton Punch & Insert Co., Valley St., Dayton 4, Ohio. **L-1-4**

### Lathe

Profusely-illustrated 20-page booklet, Form 502, presents recently introduced lathe, designed particularly for speed and economy on broad range of operations. Emphasizes time and money saving features explaining how they are accomplished by the design advances in the machine; includes discussion of construction features of the unit, descriptions of accessories, and table of specifications. Monarch Machine Tool Co., Sidney, Ohio. **L-1-5**

### Beryllium Copper

"Applications Unlimited" provides data on beryllium copper and also outlines ways in which this metal may serve in solving design problems, pointing out specific examples in actual use; emphasizes its advantages and special features, and discusses its present expanding use for diverse products. Illustrated to show various points. The Beryllium Corp., Reading, Pa. **L-1-6**

### Temperature Control

Bulletin P-811 presents 077 Electronic temperature controller with range to cover —100 to +600 F; includes specifications, application information and data on resistance therometer elements and wells, and Modutrol and Industrial Control motors for use with it. Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia 44, Pa. **L-1-7**


## He Asked Permission to Stay

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EIGHT THOUSAND marines lay besieged at Yudam-ni; three thousand more were at Hagaru-ri, preparing a breakthrough. Guarding a frozen mountain pass between them, Major Barber, with only a company, held their fate in his hands. Encirclement threatened him. But he asked permission to stay, and for five days the company held the pass against attack. When relief came, only eighty-four men could walk away. But Major Barber's action had saved a division.

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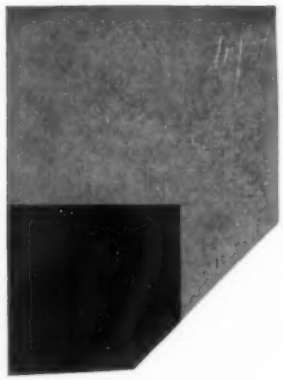

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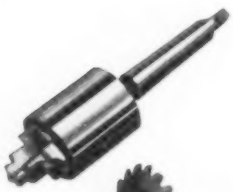

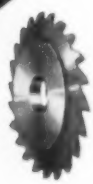

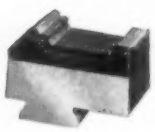

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### Gearmotors

Fifteen page booklet describes complete line of Life-Line gearmotors; pointing out special features; gives gear ratios for single, double and triple reduction types, describes especially developed designs for particular requirements. Illustrated. Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa. L-1-8

### Milling Cutter

Widely illustrated brochure presents technical data on Kroslok milling cutter and shell end mill stressing advantages gained through its use due to its construction and operation superiority; includes specifications for Kroslok for various metals. The Motch & Merryweather Machinery Co., Cleveland 13, Ohio. L-1-9

### Broach

Designed for quick reference, brochure offers complete information on "Minute Man" keyway broaches and sets including a section on special broaches. Contains information on keys and keyways as well. Illustrated. The du Mont Corp., Greenfield, Mass. L-1-10

### Taps

Bulletin ST-53 contains information on tap sizes, thread forms and prices concerning complete line of Specific taps; also explains how they are designed and the consequent advantages; describes characteristics of each type, and its suitability to particular material. Detroit Tap and Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich. L-1-11

### Drilling

Variable speed machine for drilling small precision holes at production speeds presented in folder V-53; gives information on physical details as well as operational particulars; illustrated. The Hamilton Tool Co., Ninth St. at Hanover, Hamilton, Ohio. L-1-12

### Loading Hooks

Pamphlet shows various coil loading hooks pointing out their applications and advantages; lists their specifications and capacities, and outlines their advantage. F. J. Littell Machine Co., 4127 N. Ravenswood Ave., Chicago 13, Ill. L-1-13

### Magnetic Chucks

Revised comprehensive Catalog 411 covers range of electromagnetic chucks giving sizes, specifications and prices plus general information concerning applications and advantages of magnetic chucking. Illustrated. The Taft-Peirce Mfg. Co., Woonsocket, R. I. L-1-14

### Jig and Fixtures

Catalog "The Standard Jig and Body Fixtures" describes these parts and explains their use as aids in reducing design, tooling and production costs. The Smith Engineering & Tool Co., 191 Ray Ave., Glen Ridge, N.J. **L-1-15**

### Laps

Illustrated brochure deals with line of adjustable hole laps stressing special features and advantages; includes specifications and prices and also instructions on care of these tools. Brickner-Kropf Machine Co., Muskegon Heights, Mich. **L-1-16**

### Control Valves

Condensed Catalog 531 describes Quick-As-Wink line of air and hydraulic control valves, couplings and associated parts; sectional views allow examination of special features and operation; list includes sizes, actions, permissable pressures, temperatures and other data. C. B. Hunt & Son, Inc., Salem, Ohio. **L-1-17**

### Furnace Controls

Detailed engineering specification, data to help in selection and price information on line of control systems for furnaces, ovens, dryers and kilns included in 48-page Bulletin P1260 illustrated by photos and application and dimension drawings. Indexed for convenient reference. The Bristol Co., Waterbury, Conn. **L-1-18**

### Surface Finishing

Technical Bulletin 51 covers methods of treating metal surfaces with peroxygen compounds; includes discussions of bright dips, cleaning solutions, passivation and inhibitors, involving steel, aluminum, brass, silver and stainless steel. Gives details on their use, including numerous solution formulas, and citing examples. Buffalo Electro-Chemical Co., Inc., Station B, Buffalo 7, N.Y. **L-1-19**

### Steel Coating

Brochure tells how to apply better zinc phosphate coatings to steel in preparation for painting, while stressing advantages of these coatings. Illustrated. Oakite Products, Inc., 19 Rector St., New York 6, N.Y. **L-1-20**

### Chucks and Collets

Line of Draw-In chucks and steps collets described in catalog which explains fine points of company's controlled manufacturing process and resultant advantages to the products. Elgin Tool Works, Inc., 1772 Berteau Ave., Chicago 13, Ill. **L-1-21**


# Why buy expensive tooling

**...when Dumore Drill Heads will mass produce small holes *at a fraction of the cost!***

This setup consists of six Dumores — mounted four above and two below an indexing table. It solved the problem of production drilling and chamfering two holes (.038" and .076") in a tiny (.109") brass part.

NOW, with Dumore Automatic Drill Heads, you can put small hole drilling on a profitable mass production basis without making a major investment!

Low-cost Dumore Automatic Heads mount in any position...are easily set up to handle practically every small hole drilling operation. They make it simple to drill multiple holes in a single workpiece in only one operation . . . are equally efficient as components of multiple station high-production machines.

Why? Because these compact, 17½-lb. precision tools are self-contained . . . require no expensive air or hydraulic lines . . . have built-in automatic controls.

However, outstanding productivity and flexibility are not the only advantages Dumore Drill Heads offer. They also give you substantial benefits that effect conservation of skilled labor . . . big reductions in drill breakage. So get all the facts now. Contact your Industrial Distributor or write:

**DUMORE PRECISION TOOLS**
The Dumore Company
1325 Seventeenth Street • Racine, Wisconsin

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### Turret Lathe

Informative Bulletin 130 presents facts on 4-D automatic turret lathe such as design and construction information, operation data and advantages. Potter & Johnson Co., Newport Ave., Pawtucket, R.I. **L-1-22**

### Fixture Components

Expanded line of more than 500 jig and fixture components described in illustrated folder. Jergens Tool Specialty Co., 712 E. 163rd St., Cleveland, Ohio. **L-1-23**

### Clad Metals

"An Introduction to Clad Metals" offers a comprehensive survey of the manufacture and applications of the stainless-, copper-, brass- and other clad steels produced by this and other companies. Profusely illustrated booklet includes a General Introduction, Definition of Clad Metals, Principles of Bonding, Characteristics of Clad Metals, Methods of Cladding, and Applications. Shows basic equipment and processes used in this field. Request on company letterhead directly to Superior Steel Corp., Carnegie, Pa.

### Elevator Buckets

Illustrated 12-page Booklet 246 deals with complete line of cast malleable and Promal elevator buckets for handling various types of materials; tables give dimensions, weights and capacities; includes detailed information on mounting and also on various chain attachments and elevator bolts. Link-Belt Co., 307 N. Michigan Ave., Chicago 1, Ill. **L-1-24**

### Tool Block

Six-page illustrated folder tells about Lathemaster 4-faced tool block and instant change tool holders, emphasizing various advantages in economy, increased production, versatility. Marvic, Inc., 350 Peninsular Ave., San Mateo, Calif. **L-1-25**

### Machining

Well illustrated brochure "The Tool for Precision Milling, Boring and Grinding" presents the Versa-Mil in use for various applications stressing its versatility, adaptability and efficiency; drawing shows basic design. Included are illustrated catalog sheets giving pertinent data on various attachments for the machine such as the external and internal grinders, universal dividing, and cutting heads, and other accessories. Versa-Mil Co., 33 W. 42nd St., New York 36, N.Y. **L-1-26**

### Layout

Catalog explains reproduction templets and their use in plant and shop layout planning; pointing out resultant advantages. Presents catalog listings of available templets for machine tools, auxiliary production equipment, incidental shop equipment, office equipment and building details; listed according to manufacturer, specific piece, and model. Repro-Templets Inc., Oakmont (Allegheny County), Pa. **L-1-27**

### Feed

Leaflet presents factual information on 2½ in. Model K Hitch Feed; includes photograph specification details. H. E. Dickerman Mfg. Co., 321-324 Albant St., Springfield, Mass. **L-1-28**

### Inspection

Folder "X-ray Analysis—Three Way Tool of Industry" tells how to use X-ray analysis, giving complete details on procedure used in production control and in laboratory applications. Shows typical films and charts and drawings which show difference in geometry and construction. Typical cases illustrate various points. North American Philips Co., Inc., Research & Control Instruments Div., Mount Vernon, N.Y. **L-1-29**


*Only* **MARVEL** *builds all four**

*HACK SAWING MACHINES
*BAND SAWING MACHINES
*BAND SAW BLADES
*HACK SAW BLADES

While it is true there are several builders of hack sawing machines and many builders of band sawing machines, only MARVEL builds BOTH hack saws and band saws. The fact is that MARVEL manufactures 35 models of 10 basic type of metal sawing machines which include the world's fastest automatic production saw, the world's largest giant hydraulic hack saws, the world's most versatile band saw and the most widely used small shop saws.

With intimate and broad field experience in all types of metal cutting-off equipment and 35 different saws available, it is obvious that MARVEL Field Engineers occupy a unique and exclusive position in the industry. They are eminently qualified to make expert and unbiased recommendations covering the type, size and model of metal sawing equipment best suited to individual requirements—that most efficient, most accurate, fastest, broadest in scope and the most economical.

MARVEL is also the only manufacturer of both metal sawing machines and metal sawing blades. Because the efficiencies of both the machine and the blades are interdependent, each upon the capability of the other, expert knowledge covering both saws and saw blades is essential to the proper appraisal of any specific sawing situation. Correct balance of cutting speed and blade life, feed pressure and blade tension are all potent factors in over-all performance. Here again it is the MARVEL Field Engineer who is qualified to provide the comprehensive answer to your question. His job is to help you saw metal most efficiently—his services are available upon request—gratis.

WRITE FOR CATALOG 49

**ARMSTRONG-BLUM MFG. CO.**

5700 Bloomingdale Ave., Chicago 39, U.S.A.

MARVEL Metal Cutting SAWS
No. 9A Marvel Hack Saw
No. 8 Marvel Band Saw
MARVEL High-Speed-Edge HACK SAW BLADE
MARVEL Metal-Cutting BAND SAW BLADE

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-1-150

# Field Notes . . .

**Lifting of** controls on nickel has freed two of its multiple-purpose chrome-nickel alloy steels for non-defense uses. The Carpenter Steel Co. announces. Carpenter No. 158 and No. 5-317 alloys designed to handle 95 percent of all alloy jobs, were both restricted to defense applications more than two years ago under National Production Authority's Order. According to the fabricators, the principal advantage of the two alloys is their across-the-board suitability for most alloy steel applications.

Still another of Carpenter's steels released by removal of NPA controls is the columbium-bearing Stainless No. 20. This sulphuric acid resisting stainless has been restricted since outbreak of hostilities in Korea, and since then has been available only for defense applications and the Atomic Energy Commission.

V V V

**Fifty years in** field of thread cutting and threading machinery is celebrated by Landis Machine Co. In commemoration, the company issued a booklet, "Landis Men and Machines" which graphically traces the company, its times and development, not only from its organization back in 1903, but from 1887 when A. B. Landis conceived and developed his first thread cutting die head, representing a radical departure from the then accepted principle.

## expansions

**Fabrication of** precision silicone parts will be the work done when the new plant now being built by Goshen Rubber Co., Inc. gets into production. Completion of the facility, located at Gosen, Ind., is expected during the first quarter of the year.

V V V

**Hope of stripping** a third from the length of time required now to assemble test and prepare for dipping their products is anticipated by Gleason Machine Works as it swings into full operation at its new $2½-million assembly plant. Basically, the facility, with its 80,000 sq ft of floor space, makes Gleason one mammoth assembly line with products moving in a steady flow from foundry to dock. Leaving the foundry at the east end of the layout, heavy cast parts move toward finishing, milling and drilling at the main plant, on to assembly, complete test runs, to painting, re-testing, and eventually to the loading platform.

An interesting phase is the testing laboratory for machines marked for world wide destinations. To test them, the plant must be able to duplicate strange and unusual cycles and voltages used in Europe, Asia, Australia and the Americas.

V V V

**As first step** in an extensive expansion program, Westinghouse Electric Corp. has earmarked $4,000,000 for its Appliance Division plant in Springfield, Mass. The appropriation will be used to realign manufacturing facilities and

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... not because they cost more (in the long run they're more economical) but because they're completely *impersonal*. They do their measuring jobs absolutely independent of the human hand.

For more than 50 years, Ames Micrometer Dial Gauges and Indicators have kept pace with increasingly critical precision requirements. Today, each part of every Ames product is carefully built by exclusive Ames methods and machines from the materials best suited to its function — and 100% checked for accuracy. As a result, all Ames products are extremely accurate and sensitive, yet rugged and tough — to give you *longer* service with *less* down-time.

*Ames Dial Comparator No. 13*

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equip the plant with the latest tools and machines, according to J. R. Weaver, plant manager. The entire amount, he said, will be spent for production equipment to increase the division's output. No additional building construction is planned at this time.

V V V

**Twenty-two acres** of land near Belvidere, Ill., have been purchased by Sundstrand Machine Tool Co. of Rockford, Ill., in preparation for construction of a new plant for building heavy machine tools. The step was taken in view of a request by the federal government for dispersal of plants at such time as plans were carried out for new construction.

V V V

**Metal Carbides Corp.** is completing construction of a 40,000-sq ft plant at 6001 Southern Blvd., Youngstown, Ohio, which is scheduled for operation this January. The facility will be used to produce tungsten carbide metal, and also tantalum and titanium carbides as well as tungsten alloy heavy metal, cermets and high temperature alloys, all produced by powder metallury methods. The new unit will be operated in addition to the main plant at 107 E. Indianola Ave., Youngstown, Ohio.

V V V

**Plant and manufacturing** facilities at Watson Stillman Fittings Div., H. K. Porter Co., Inc., Roselle, N. J., will undergo a $250,000 expansion which will include additional land, buildings and installation of specially designed automatic machine tools for increased production.

## new ventures

**Development of** special instruments and instrument components to contract specifications will be the responsibility of the newly created Special Products Div. announced by Fischer & Porter Co. This is the company's most recent step in a planned program for expanding its service to industry. Edward H. Muhleisen, who has served both as field and applications engineer for the company, will manage the division.

V V V

**Ferro Powdered** Metals, Inc., Salem, Ind., has been formed as a wholly owned subsidiary of Ferro Corp. The plant is equipped to furnish high-precision powder metal machine parts, for the aircraft, automotive, appliance, business

ma[illegible]e and agricultural equipment ind[illegible]ies.

[illegible]). Clawson, Ferro Corp. president, he[illegible] the new subsidiary as president, an[illegible]harles B. Hughes is vice-president an[illegible]eneral manager.

v v v

**Erection of** a metal-rolling mill to roll magnesium is under way by Dow Chemical Co. of Madison, Ill. The plant is expected to be in production, turning out a wide variety of magnesium coiled-sheet products varying from structural shapes to thin strips, by early 1954.

v v v

**Opening of** a modern $1,500,000 tool and die plant at Fort Madison, Iowa, marks the entry of The Sheaffer Pen Co. into a new endeavor. The new plant will produce tools, dies, fixtures and special machines for both the pen and other outside companies. It is headed by A. A. Zuber, former vice-president and a director of Carver Pump Co.

## consolidations

**Two Detroit** industrial concerns, Peninsular Grinding Wheel Co. and Motors Metal Manufacturing Co., have signed an agreement to merge. Stockholder meetings were called for January 5 to vote on merger terms. The resultant company would be known as Abrasive & Metal Products Co., though the two firms would continue to operate as divisions of the concern.

v v v

**Capital stock** of the Pope Machine Co., Inc., Seattle, Wash., has been purchased by Kling Brothers Engineering Works, makers of steel fabricating machinery. The Pope plant will continue to operate in Seattle as a subsidiary of Kling. In commenting on the transaction, Arthur H. Heist, new president of the subsidiary, said the acquisition would greatly amplify the line of bending and angle rolls being made at present at the Kling plant and also bring to the market an advanced design of bending rolls. He stated that the combined companies will now be one of the leading producers in this field.

v v v

**Two divisions of** Avco Manufacturing Corp., Lycoming-Spencer and Bridgeport-Lycoming, have been consolidated into a single Lycoming Div. According to Victor Emanuel, chairman and president of the company, the


**WHELAND COMPANY solves warpage problem, saves time, labor and materials with**

# FARQUHAR Hydraulic Presses

This straightening operation utilizes a 50-ton Gap-Type Farquhar Press on an 8-hour-day production basis.

500-ton Farquhar Hydraulic Press straightens 16′ A forged tubes at The Wheland Co., Chattanooga, Tenn.

THE Wheland Company, Chattanooga, Tennessee, uses Farquhar hydraulic presses to help speed production of vital defense products. For example, a 500-ton Farquhar Press is used for straightening forged tube approximately 16′ long, varying in outside diameter from 6″ to 10″, with an inside bore of 2″ diameter. This operation alone has solved one salvage problem, since less scrap results as stock distribution is equalized by straightening.

Scrap and salvage due to warpage have been eliminated in another operation, where a 50-ton Gap-Type Farquhar Press is used to straighten 7/8″ bars, 3″ wide, 65″ long. Together, the two presses have speeded production. Neither press has required any maintenance other than regular services since installation!

**Farquhar Presses Cut Your Costs**

Just one more example of cost-cutting Farquhar performance in modern production! Farquhar Presses are built for the job . . . assure faster production due to rapid advance and return of the ram . . . greater accuracy because of the extra guides on the moving platen . . . easy, smooth operation with finger-tip controls . . . longer life due to positive control of speed and pressure on the die . . . long, dependable service with minimum maintenance cost!

Farquhar engineers are ready to help solve your production problems. Your request will bring them running . . . at no obligation, of course.

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*Push* or *Pull*

. . . and no matter which way you operate your broaching *machine* . . . it is still the *broach* that does the cutting.

When you entrust the accuracy of your broach to "Connecticut," and to "Durakeen," you obtain the degree of accuracy that pre-determines the quality and interchangeability of the broached parts. When finished with a Durakeen broach, the first and one-thousandth part are identical.

No one can give you better high-speed steel than Durakeen . . . and we have many loyal customers who feel the same way about the high quality of Connecticut broach design and production engineering.

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move was made to serve the multiple purpose of simplifying administration, expanding and integrating research and strengthening its competitive position in the field.

V V V

**Preliminary arrangements** for a merger of American Metal Products Co. and Tube Reducing Corp. have been completed and have been approved by the two boards of directors. American Metal will continue to operate both businesses with separate corporate identities and no changes in present managements, according to announcement from the firms. Merger plans include dual expansion of manufacturing at both plants to meet expanding markets in the eastern and central areas these plants now serve; and although no specific arrangements are made at present, a combined facility on the West Coast already is being actively considered.

V V V

**Operation of** the Buda Co., 72-year-old Harvey, Ill., firm, has been assumed by the Allis Chalmers Mfg. Co. It will be operated as "The Buda Co., a division of Allis-Chalmers." In charge as president and general manager will be Ralph K. Mangan who has been with Buda for 36 years, and president since 1950.

With this division, Allis-Chalmers now operates 16 factories, 12 of which are in the United States, two in Canada and two in England.

## lines and services

**Installation of** complete Nicro-Brazing equipment in its new Terre Haute, Ind., plant places Twigg Industries, Inc., among the few companies offering facilities to handle the metalworking process. The process, which is a nickel-chrome brazing technique, was developed especially for use with stainless steel and other high nickel alloys and is important in the fact that it will give satisfactory strength and corrosion resistance at high temperatures.

V V V

**Hydraulic Power Div.** of The Hydraulic Press Mfg. Co., Mount Gilead, Ohio, now announces that it can provide a complete line of hydraulic components. According to H-P-M president John C. Cotner, this offers a considerable advantage to industry to be able to select and lay out a hydraulic circuit from one source and one set of catalogs.

# Abstracts of Foreign Literature

By M. Kronenberg

## Face Milling of Steel

A survey of present practice and theory on face milling of steel is presented by H. J. Burmester in the October 1953 issue of *Werkstatt und Betrieb*. He states that the power required for face milling of steel is approximately two to three times that for milling of cast iron. For this reason milling machines for face milling of steel must be built considerably more rigid than before.

Two machines of rigid design are illustrated, one of German, the other one of French origin. The latter incorporates some new features such as three round columns supporting the vertical head in a triangular fashion. The author further indicates that the metal removed (cu in. per min. per hp) may be used as a guide for cutting efficiency. This opinion is open to discussion because it can be proved that metal removal in cu in. per min. per hp is nothing else but the reciprocal of the unit cutting force multiplied by a constant. Hence tool life does not enter here but only the cutting resistance offered by the metal and the geometry of the tool.

Among the design items mentioned in the article the adoption of ISO Standard (DIN-2079) for the spindle nose is of interest; the author recommends the newer standard because of vibration experienced with the older standard DIN 2201. The number of teeth for the face mills increases from 6 to 28 for cutter diameters between 5 inches and 40 inches in machining steel as against from 8 to 38 in milling cast iron.

Carbides developed for steel milling in Germany are given in a tabulation comparing types made by different manufacturers with standardized types. In the author's opinion only types S2 and S3 should be used for steel milling. Details are also included in the article on cutter diameters, sizes of teeth, true rakes and angles of inclination recommended for various steels and steel alloys. The true rakes are mostly negative, while the angles of inclination are given with positive signs. It must however be borne in mind that, due to differences in the definition of the angle


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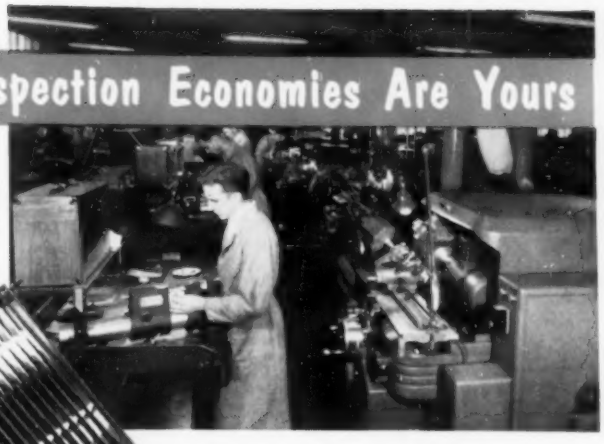

A section of the Lincoln Park thread grinding department showing a portion of the modern equipment in regular use.

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Carbide OR Steel

THREAD GAGES

● The manufacture of plug thread gages has been a Lincoln Park specialty for many years. In fact, this company was the first to successfully produce carbide thread gages. It is this experience that assures you of gages of unquestioned accuracy and maximum service life.

Today, Lincoln Park carbide thread plug gages are supplied in a standard size range from a No. 4 machine screw size to 3″ diameter . . . in steel from No. 0 to 6″ diameter. Almost any specifications for tolerance, lead or pitch can be met. Many sizes can be delivered immediately from stock and prompt delivery can always be expected on all others.

Our new catalog lists and prices thread gages as well as all other products manufactured by Lincoln Park. Your copy will be sent you if requested on your company letterhead.

**Lincoln Park offers the facilities for many of your precision production thread grinding needs. We invite your inquiries.**

DESIGNERS AND MANUFACTURERS OF:
SPECIAL AND STANDARD CARBIDE, CHROME PLATED, AND STEEL GAGES—CARBIDE ROTARY FILES—ALSO, FACILITIES AND SKILLED PERSONNEL AVAILABLE FOR PRECISION PARTS PRODUCTION.

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**3800 PER HOUR!**
**2500 PER HOUR!**

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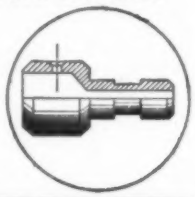
**FULL UNIVERSAL MACHINES**

**Air operated, electrically controlled Snow tools are establishing amazing production records daily on a wide variety of work. Just note these typical examples:**

**DRILLING**

**Crossdrill and C'T" Sink 1/16" Hole**

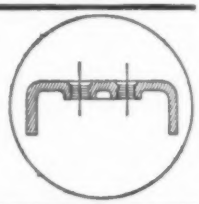
Material—Brass
Production—4800 per hour
Fixture—#15 Vertical index
Equipment—#1-UD Drilling Machine



**TAPPING**

**Tap Two #10-32 Holes**

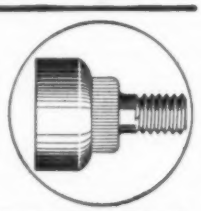
Material—Steel stamping
Production—3800 tapped holes per hour
Fixture—#14 horizontal index
Equipment—#1-UT tapping machine



**THREADING**

**3/8"—24 Thread—1/2" Long**

Material—Die Cast Aluminum
Production—2500 per hour
Fixture—#10 Drum dial
Equipment—#3-TR Threading machine



Snow air operated—electrically controlled machines have built in full universal controls that allow selection of the type of spindle cycle desired. This feature also permits instant synchronization of the standard Snow Master Fixtures. All types of air operated automatic and semi-automatic jigs and fixtures are carried in stock. Standardization permits low cost tooling—and—high production.

Sensitivity of power application prevents tool breakage.

Simplicity of control means that set up and operation can be handled by a less experienced operator with minimum fatigue.

**SNOW**

**MANUFACTURING COMPANY**
435 Eastern Ave., Bellwood, Illinois
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Single Spindle Verticals • Two-Spindle Verticals • Two-Spindle Horizontals • Automatic Nut Tapping Machines • Drill Press Tap Heads • Automatic & Semi-Automatic Jigs & Fixtures

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of inclination, a positive angle of inclination in European practice corresponds to a negative angle in American practice.

Numerous other data are given in the paper such as feed per tooth, cutting speed and power requirements. The extension used in Europe for tool life of milling cutters corresponds approximately to that which has been adopted in U.S.A. several years ago; namely, a wear land of 0.030 inch in U.S.A. as against a wear land of 0.020 to 0.025 inch for medium steels and 0.032 inch for hard steels in Europe. This differentiation in the wear land is caused by the geometry of the tools. Various types of milling cutters are discussed, among them a design permitting grinding of the teeth outside of the cutter body. Hence it is unnecessary to stock a great number of cutters. Only replacements for the blades are needed when a cutter becomes dull. A special feature for accurately inserting the teeth is likewise illustrated.

### Cutting Forces in Turning

Formulas for the calculation of cutting forces are also discussed in an article by E. Kuhn in the 10-1953 issue of *Werkstatt und Betrieb*. The author compares his findings with those published by Kronenberg in THE TOOL ENGINEER (January, February, 1940) and finds that his data agree quite well with this earlier research.

### Design of Milling Machines

Recent development in the design of European milling machines is the topic of another article in the October issue of *Werkstatt und Betrieb*. The author, G. Kronhagel, describes milling machines with electro-hydraulic preselector drives and rigid construction for heavy cuts.

A special kneetype miller for the machining of high workpieces is illustrated where the table is vertically arranged rendering it possible to accommodate workpieces which could hitherto not be machined on this type of milling machines. The cross feed is obtained by moving the cutter along the arbor. Another special miller, built for high accuracy, employs high spindle speeds and precision bearings. It is claimed that the surface finish obtained in milling operations compares favorably with that of grinding.

A tracer controlled miller of recent design is discussed by F. Sallwey in 10/1913 of Werkstatt Technik und Maschinenbau employing high frequency driven motors for the spindles of 0.5 kw and 300 cycles per second for finishing operations. The spindle speeds

...itely variable between 3,000 and 18... rph. For roughing operations the ...achine can be equipped with another head incorporating a 1.85-kw motor ... spindle speeds between 200 and 3,0... rpm. The machine is particularly well adapted to die sinking and similar milling operations controlled by a master which can be made of any material including plaster of paris, wood, etc.

The tracer finger is electronically controlled and operated by way of three hydraulic pistons. The tracer leads the cutter by a small travel distance of about 0.0006 inch and makes it possible to mill vertical walls. The accuracy of tracing, it is claimed, is as high as 0.004 inch.

---

**Arrangements are now** complete between Firth Sterling Inc. and Prof. Dr. Ary Torres, Brazilian Industrialist, in anticipation of the immediate formation of a Brazilian company in Sao Paulo. According to the announcement, the firm is designed to become the counterpart of Firth Sterling in that country. Operations are scheduled to begin shortly after the first of the year. Plans already are under way for construction of a plant to produce sintered tungsten carbides in Brazil utilizing local raw materials.

**Brook Motor Corp.,** Chicago, has been organized as a subsidiary of Brook Motors, Ltd., England, to introduce and direct U.S. and Central American sales of the parent company's electric AC motors. In charge of the new firm are M. E. Stern, vice-president and assistant treasurer, and Peter L. Loewe, vice-president and assistant secretary.

**Comment from** the talk "Are We Prepared for World Competition" made recently by Swan Bergstrom, president of National Machine Tool Builders' Assn. speaking at that organization's annual meeting, indicated that of the peoples whom we have helped in building up their industries through dissemination of our technical and productive know-how, the people of Western Europe have probably been the most successful.

He further stated that our recent emergency has left the door open for foreign builders to sell their machine tools in this country. Some of these are inferior, some fair and others "have given a pretty good account of themselves." Due to our defense program and those of Great Britain and France, Western Europe's machine tool industries have been able to build themselves up to a point where they are today a "challenge for the world machine tool markets."

## We help our customers write success stories

Every day 200 Oakite Technical Service Representatives use Oakite cleaning materials and methods to help thousands of Oakite customers accomplish metal-cleaning jobs that are important parts of big production operations.

When a busy customer sends a few words of appreciation, we treasure those words as a *success sentence* that we have helped write in his *success story*.

Here are brief explanations of the *success sentences* quoted above:

1. After 6 months use of Oakite Special Protective Oil for preventing rusting, this manufacturer of precision steel parts estimated savings at more than $6,000.
2. The use of Oakite Composition No. 95 for conditioning zinc-base die castings before plating cut cleaning rejects for this hardware manufacturer and showed other "very fine advantages."
3. Oakite CrysCoat HC put a heavy phosphate coating on 385,000 shells with "absolutely no trouble" according to a munitions maker, who added that "maintenance and control are very easy."
4. For burnishing, "Oakite Composition No. 3 is here to stay" says this maker of aircraft instrument parts, who adds "Pinions are polished to the roots of the gears. Magnesium parts are brilliant."

How about your success story? We'll be glad to tell you how we can help. Just drop a note to Oakite Products, Inc., 34E Rector St., New York 6, N. Y.

**FREE** Ask for our booklet "*Some good things to know about Metal Cleaning.*" It discusses our methods for:

| | |
|---|---|
| Tank cleaning | Pre-paint treatment |
| Machine cleaning | Burnishing |
| Electrocleaning | Paint stripping |
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**OAKITE**
MATERIALS • METHODS • SERVICE

Technical Service Representatives in Principal Cities of U. S. and Canada

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-1-157

# Men at Work . . .

According to the announcement from Magnesium Co. of America, **George O. Bohrer** has been made chief engineer of the company. For the past three years, Mr. Bohrer has been assistant plant manager of Continental Can Co.

At the same time, **C. Ridgely Kemp,** vice-president in charge of production, was appointed to the newly created position of vice-president in charge of research and development. Another vice-president of Magcoa, **William R. Davison,** who has been in charge of foundry operation, assumes Mr. Kemp's former position.

Two executive positions in the Baker-Raulang Co. have been filled by **John A. Matousek** and **Ernest R. Scovil.** Mr. Matousek, formerly vice-president of manufacturing, is now vice-president and general manager. Mr. Scovil, who has been secretary of the company, is now both secretary and treasurer.

Directors of Vanadium-Alloys Steel, Canada, Ltd., have elected three men to fill executive posts. **J. P. Gill,** vice-president of Vasco Canada, and executive vice-president of Vanadium-Alloys Steel Co. was elected president of the Canadian company. He fills the unexpired term of **Jean Paul Elkann,** whose resignation was accepted at this same meeting of the directors. Mr. Gill is a member of ASTE's Pittsburgh chapter.

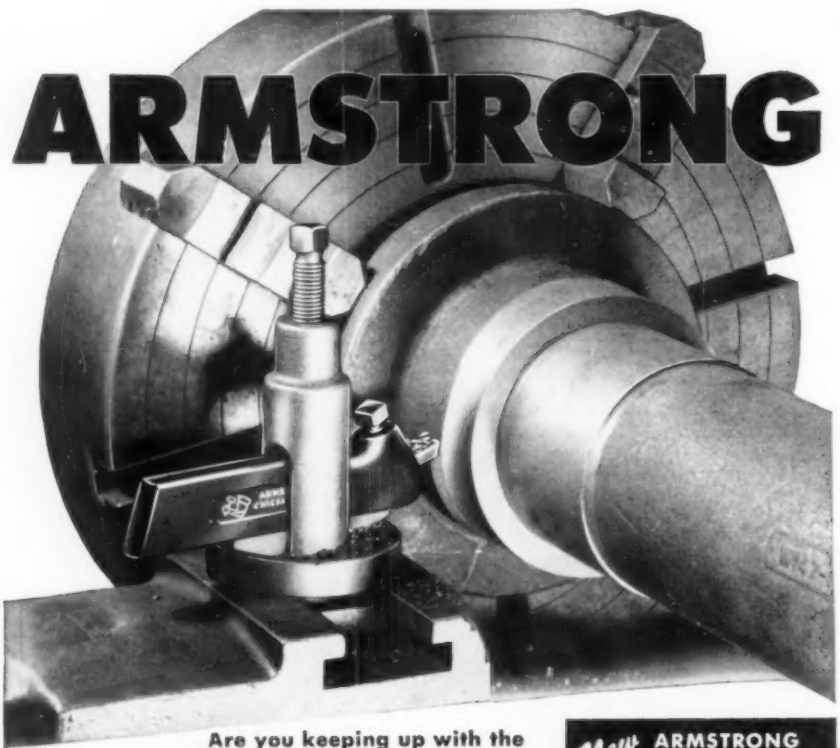
Other executive elections included **L. D. Bowman,** vice-president in charge of operations for Vanadium-Alloys in Latrobe and a member of Vasco Canada board of directors, was elected vice-president of the Canadian firm. **Burns George,** vice-president in charge of sales at the steel company in Latrobe, was elected a director to fill a vacancy on the board.

Wheeler Associates, Inc., has announced the appointment of **Robert Nightingale** as director of the engineering staff. Mr. Nightingale formerly was chief engineer of the Colson Corp.

The board of directors of Hewitt-Robins Inc. has elected **Ellis B. Gardner** and **Robert A. Nilsen** vice-presidents of the company. Mr. Gardner, who has been controller of the firm since 1950, is a member of the Rubber Industry Advisory Committee to the Defense Materials Agency. Mr. Nilsen, who joined Hewitt-Robins in 1946 when that company entered the foam rubber filed, is general manager of the foam rubber division.

Also recently announced from Hewitt-Robins was the appointment of **A. F. Dantino** as production manager of the industrial rubber products plant. Mr. Dantino has been associated with the firm for the past 15 years. At the same time, **Harold Stockman,** formerly night superintendent, was named production superintendent.

**Thomas D. Nast** has been made president of All-State Welding Alloys Co., Inc. According to the directors, the move was designed to elevate technology to the topmost place in All-State affairs. Mr. Nast is responsible largely for alloy developments the company feels have resulted in its recent rapid growth.


**Are you keeping up with the Armstrong System of Tool Holders**

Doubtless you are daily using ARMSTRONG TOOL HOLDERS that have been in continuous operation for many years. This is sound practice, for this means added profits without added tool costs. But to become complacent, so satisfied that you forget your ARMSTRONG TOOL HOLDERS, is unwise. The "Armstrong System" is a growing thing, with new types and sizes of ARMSTRONG TOOL HOLDERS constantly being developed to more effectively meet new machining conditions, or to take advantage of newly developed cutting materials.

With modern ARMSTRONG TOOL HOLDERS for each operation, you can greatly increase speeds and feeds. You can lower machining cost and further increase profits.

If you haven't kept up with the "Armstrong System" write for an ARMSTRONG Catalog and check to see that you are using the most efficient ARMSTRONG TOOL HOLDER for each operation on all lathes, planers, slotters and shapers.

*WRITE FOR CATALOG*

New ARMSTRONG TOOL HOLDERS
ARMSTRONG Spring Form Threading Tool Holder
ARMSTRONG Spring Cutting-off Tools
ARMSTRONG Carbide Tool Holders for Carbide-Tipped Cutters
ARMSTRONG "C-A" Tool Holders for ARMALOY (Cast-Alloy) Cutter-Bits

**ARMSTRONG BROS. TOOL CO.** *"The Tool Holder People"* 3257 W. ARMSTRONG AVENUE CHICAGO 30, ILL.

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J. T. **O'Brien has been named vice-president-operations for Firth-Sterling, Inc. Prior to election to his present post he was Works Manager in charge of all company operations.**

**William H. Harris, Jr., vice-president in charge of engineering at Micromatic Hone Corp., now joins its board of directors, filling the vacancy made by the resignation of Harvey C. Fuehauf.**

**Edgar D. Leon is the new president and director of The Gear Grinding Machine Co. He comes from Hickory Pattern & Foundry Co., which he owned and operated for three years.**

Election of **Philip E. Spindell** as vice-president, engineering, and **Paul Mueller** as vice-president, manufacturing, has been revealed by Template Reproduction and Engineering Co. In their new capacities, Mr. Spindell will be responsible for directing and coordinating Treco's engineering services in aircraft, automotive and other industrial fields; while Mr. Mueller will direct all of the firm's manufacturing activities in the aircraft tooling, fabricating and related fields.

Two new directors have been elected for the American Smelting and Refining Co. They are **Robert S. Macfarlane**, president of Northern Pacific Railway Co., and **James Albert Woods**, president of Commercial Solvents Corp.

**Joseph P. Stanavage** has joined the research and development division of the Pennsylvania Salt Mfg. Co. where he will work on projects of the Corrosion Engineering Products Dept. Mr. Stanavage formerly was associated with general chemicals division of Allied Chemical & Dye Corp.

**John C. Hamaker, Jr.,** has been added to the metallurgical research department of Vanadium-Alloys Steel Co. Before joining Vanadium-Alloys, Dr. Hamaker was plant metallurgist for the General Iron Works Co., a division of Stearns-Rogers Mfg. Co.

Appointment of **Robert A. Horner** as divisional manager of their Machine and Small Tools Divisions has been revealed by Barber-Colman Co. **Leo W. Reuland** succeeds Mr. Horner now as sales manager of the two divisions; and **Fred B. Jensen** assumes Mr. Reuland's former post of production manager of the Small Tool Division.


AN IMPROVED STANDARD COUNTERBORE DESIGN by ECLIPSE

NEW!

FLUTE DEVELOPMENT GIVES YOU

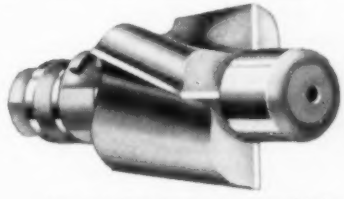
★ Deep counterboring with a *wider range* of pilot sizes.
★ A higher helix angle which assures *faster chip disposal.*
★ New tooth construction thus providing maximum *heat dissipation.*

The DIFFERENCE at a glance!

End view of counterbore showing conventional flute form, designed for spot facing and *shallow* counterboring.

New style flute form designed for spot facing and deep counterboring; chips can flow freely from pilot diameter.

Side view of counterbore showing conventional flute design which provides ample chip clearance for shallow counterboring and spot facing.



New style flute form with increased helix angle permitting faster chip removal, thus reducing heat to a minimum in deep counterboring.

Our present stock is being replaced with the new design as rapidly as possible so that in the very near future all orders will be filled with this later design within the range of sizes provided.

ECLIPSE COUNTERBORE CO.
Founded in 1913
DETROIT 20, MICHIGAN
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Inspecting a special gage on a Taft-Peirce 24" x 36" Granite Surface Plate.

# New Taft-Peirce GRANITE SURFACE PLATE Keeps Measurements On The Level

**FOR PRECISION MEASUREMENTS** that require the ultimate in smooth flat surfaces, Taft-Peirce now offers something new in surface plates. A Blue-White Granite Surface Plate. Made of a granite new to toolrooms, it's harder, more wear-resistant, easier to use and care for.

**SURFACE ACCURACY** is not subject to distortion. Plate is free from all residual stresses. Temperature changes or shock can't warp it.

**SMOOTHER,** its blue-white grain is extremely fine and even — yet natural pores assure free movement of tools and instruments.

**PRACTICALLY INDESTRUCTIBLE,** heavy pointed objects dropped on the surface barely powder point of impact. No humps or burrs are raised to impair accuracy. Unique grain direction running 45° to working surface of plate prevents cracking, chipping, or breaking.

**RUST-PROOF,** no oiling or covers necessary.

**LOW POROSITY** makes moisture absorption negligible. Tools or work left on this granite surface are not subject to rust.

**NON-ABRASIVE,** the extra-fine grain won't impregnate readily with dirt or grit particles to cause abrasion. Surface is easily wiped clean and free of foreign matter.

**NON-MAGNETIC,** it won't deflect instruments. Nor will its soft blue-white color glare or cause disturbing reflections.

**ACCURATELY GROUND AND LAPPED,** backed by more than 75 years of experience in making precision products, Taft-Peirce Granite Surface Plates are the newest addition to a famous line of layout and inspection equipment.

Write for price list today.

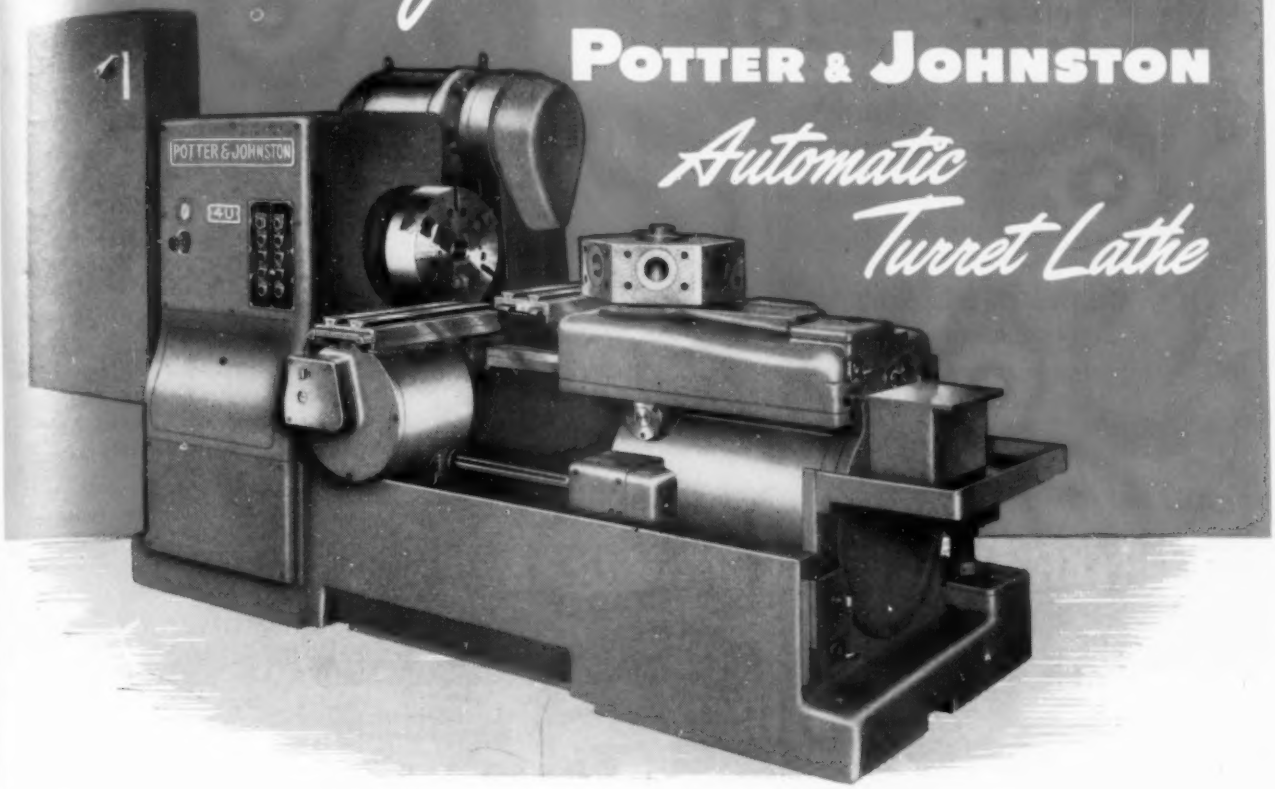
*For more information on surface plates and many other items, get your copy of the new Taft-Peirce Handbook.*

T P *T-P means Top Precision*

**THE TAFT-PEIRCE MANUFACTURING COMPANY • WOONSOCKET, RHODE ISLAND**

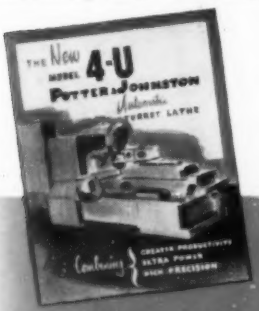
# *Introducing* THE NEW MODEL 4-U

## POTTER & JOHNSTON *Automatic Turret Lathe*




There's one way to beat today's rising production costs . . . turn out the work faster, more economically. And this new P&J Model 4-U is designed to do just that! It's a tough, rugged workhorse with that EXTRA power that's needed to take full advantage of modern carbide tooling for fast metal removal on the toughest alloys. Want proof? A recently installed 4-U consistently removed **4 pounds of 1118 SAE steel in just 30 seconds** . . . in regular, production line operation.

But speed and toughness aren't all; the 4-U is also extremely versatile and offers unusual opportunities for tooling that will help cut machining times to a money-saving minimum.




### SEND NOW FOR COMPLETE INFORMATION

Write direct or contact your nearest Pratt & Whitney Branch Office. Ask for your copy of Bulletin No. 153.

### *Features*

**25 HORSEPOWER MOTOR** . . . for fast metal removal on the toughest alloys.

**CAPACITY** . . . chuck sizes: 10″—12″—15″

**EXTRA LARGE DOG DRUM** . . . reduces set-up time

**ALL-CLUTCH DRIVE** . . . allows instant starting and stopping of spindle and changes of automatic speeds.

**INDEPENDENT FRONT and REAR CROSS SLIDES** . . . for added tooling versatility

**HEAVY DUTY PRECISION SPINDLE** . . . *is* accurate, *stays* accurate.

BIRMINGHAM • BOSTON • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • ROCHESTER • SAN FRANCISCO • ST. LOUIS • EXPORT DEPT., PAWTUCKET, RHODE ISLAND

AGENTS: DALLAS, THE STANCO CO. HOUSTON, WESSENDORFF, NELMS & CO.

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DIVISION NILES – BEMENT – POND COMPANY

COMPETE PROFITABLY — P&J — REPLACE WITH P&J

# When you "SAVE"... YOU LOSE!

"Saving" by making your own punches is old-fashioned and expensive.

Check your labor costs — your "down-time" — and order

**PORTER PUNCHES**

— for immediate delivery. Save time — save money — with top quality punches and die buttons. Look to Porter for

*the punch you need... when you need it!*

Remember — you don't save by making your own punches — you lose.

*"Still the best performer"*

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Porter Punches are in stock in all principal cities. Send for complete catalog and prices—today!

*Here's why:*

1. PORTER PUNCHES are available for immediate delivery. *. . . they save time — money — by keeping your expensive help at profitable jobs.*
2. PORTER PUNCHES are made to "stand the gaff." *. . . punches made in your shop are probably made from "available" material . . often the wrong metal for the job.*
3. PORTER PUNCHES are offered in standard—and decimal sizes. *. . . so your experienced help doesn't spend costly time "whittling."*
4. PORTER PUNCHES are reasonably priced. *. . . only a "specialist" can make punches as well—or as inexpensively.*

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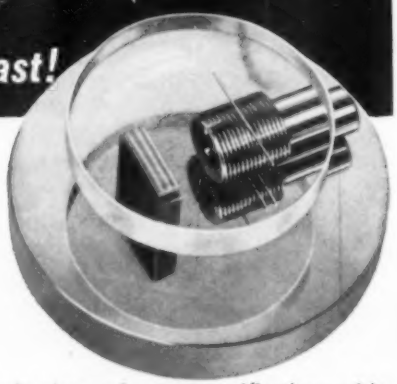
# Measure in Millionths with LIGHT WAVES

*It's Easy... Fast!*



**Determine Surface Flatness At a Glance**

Meet today's extremely close tolerance specifications with modern scientific measuring equipment. Using Acme optical equipment, it is as easy to measure to millionths of an inch, as it is to measure in tenths with a micrometer. Make your measurements via light waves with Acme equipment. Write for complete information.

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*manufacturers of optical flats and monochromatic lamps... mold polishing*

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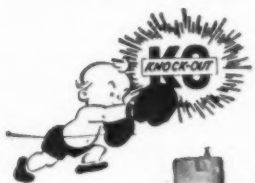
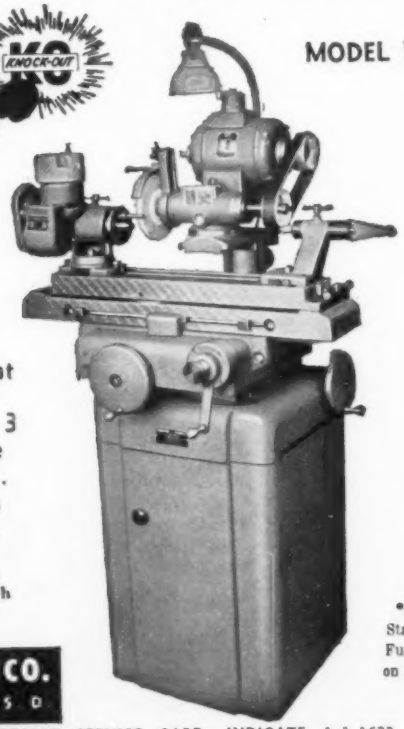
# There's a reason 76%*

of all popularly-priced Tool and Cutter Grinders sold in 1952 were *"Knock-Outs"*




MODEL B860



Will do anything that machines costing 2 or 3 times more will do . . . yes and in less time.

Distributed Only Through Franchise Dealers

**K. O. LEE CO.**
ABERDEEN, S. D.

*Sales Statistics Furnished on Request

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No. 7 in a Series

# carbide service available

data for comparison

| | |
|---|---|
| Part | Petcock Center |
| Machine | 1⅜" Six Conomatic |
| Tools | 100% Carbide Tipped |
| Material | X-1112 |
| Stock Size | 1" Hexagon |
| R.P.M. | 1562 |
| Time | 8 seconds |

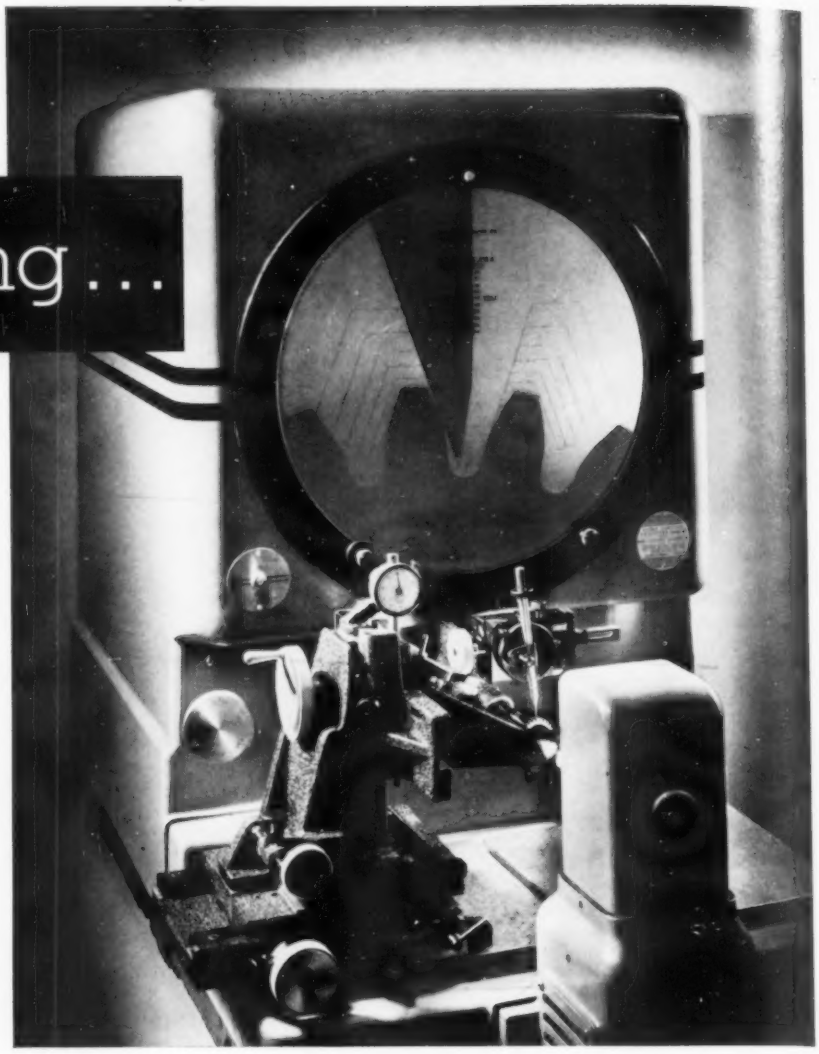
Where conditions are favorable, 100% carbide tool-ups on "Automatics" make HSS tools appear as obsolete as ancient tools of carbon steel.

In determining the "favorable" conditions, the Conomatic Carbide Development is of real service to the "Automatic" user. Without risk of production loss or obligation of machine purchase, he gets an eye-witness demonstration of the profit possibilities of 100% carbide tooling to his own work.

**Conomatic** } CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

# Announcing...

## a new method for analyzing gears by optical gaging

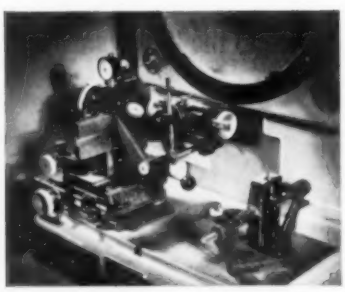


Gear analysis can now be done *visually* by optical gaging methods. With the new OGP Gear Analyzer you can check involute spur gears *functionally and analytically* under simulated operating conditions. A single chart-gage can be used for any gear with the same pressure angle to inspect, analyze, and gage the following elements:

- Involute Profile.
- Fillet Interference (or Clearance).
- Outside Diameter.
- Root Diameter.
- Pitch Diameter.
- Backlash (effective tooth thickness at Standard P.D.), by:
  - (1) Center distance
  - (2) "Slap between teeth"
- Tooth-to-Tooth Spacing—(Circular Pitch).
- Modified Tooth Form.
- Tapered Teeth.
- Tooth Crowning.
- First and Last Contact Points.
- Off-Axis Teeth—(asymmetrical).

Complete analysis of "running conditions" can be made, even when gear operates with backlash.

Write for the details on this fast, accurate gear checking method.



OGP Gear Analyzer and Set-Master for gears ⅝" to 5½" P.D. Requires no master gear.

OPTICAL GAGING PRODUCTS INC.

26 FORBES STREET, ROCHESTER 11, N. Y.

SPECIALISTS IN PROJECTION GAGING

*first quality*

# DIE STEELS

for

# HOT WORK

**HOTFORM** The original 5.00% chromium hot work steel—more widely used than any other type. Ideal for die casting dies, shell piercing tools, extrusion press tooling (for aluminum, magnesium, soft brass).

**MARVEL** High tungsten, tough, retains hardness at high heat. Popular for hot press and hot forging dies for brass and steel, refractory brass extrusion, hot swaging, hot shearing, etc.

and

**HOTPRESS**
**FORGE DIE**
**SC SPECIAL**
**WW HOTWORK**
**RED CUT SUPERIOR**
**J-Temper**

*—write for details!*

**Vanadium-Alloys Die Steels for Hot Work are produced in grades covering the complete range of applications in this field. Each grade, distinguished by brand, embodies the specialized experience of almost half a century devoted *exclusively* to the production of fine tool and die steels. Whatever your hot work requirements, you'll find profitable fulfillment in our First Quality Die Steels. Our Research Department and metallurgically-trained sales representatives will gladly assist you in correct selection. *Let us send you our booklet on Die Steels for Hot Work.***

**Vanadium-Alloys**
**STEEL COMPANY**
**LATROBE, PA.**
COLONIAL STEEL DIVISION • ANCHOR DRAWN STEEL COMPANY

# You're missing something if you don't remember CRUCIBLE HOLLOW TOOL STEEL

If you manufacture tool steel parts with cutout centers, and your aim is to reduce production time and costs, you can't afford to overlook Crucible Hollow Tool Steel. It comes in three famous grades: KETOS, AIRDI 150 and SANDERSON.

You don't have to drill and bore solid bars anymore. For these quality brands of tool steel are immediately available with machine-finished inside and outside diameters and faces — cut to your specific length requirements. And they come in a wide range of sizes.

By eliminating drilling and boring operations, Crucible Hollow Tool Steel will lower your production time per unit . . . increase your machine capacity . . . and reduce your scrap losses.

For full information and literature, call your nearest Crucible warehouse . . . or write for new brochure describing Crucible Hollow Tool Steel. Address Dept. TE, Crucible Steel Company of America, Chrysler Building, New York, N. Y.

**CRUCIBLE** first name in special purpose steels

*54 years of Fine steelmaking*

**HOLLOW TOOL STEEL**

CRUCIBLE STEEL COMPANY OF AMERICA • TOOL STEEL SALES • SYRACUSE, N. Y.

## For the "Super" Finishing Touch . . .

. . . **Brown & Sharpe Surface Grinding Machines.** Exceptional finishes with quick spark-out are assured by the rigid construction of these top producers. Their extreme ease of operation and reliable performance have earned the respect of metalworkers everywhere. They set up quickly and adapt readily to the job at hand . . . *all* controls and adjustments are within easy reach. If you want maximum versatility and excellence of finish on your surface grinding jobs, investigate the two sizes of surface grinding machines offered by Brown & Sharpe. Write for bulletins.

**Brown & Sharpe**

## "Mike" Your I.D.'s... No Masters Needed

**The New Intrimik** Internal Tri-Point Micrometer reduces measurement of bores and holes to a simple "miking" operation . . . saves you the cost of expensive plugs and setting rings. Made in 20 sizes, these handy micrometers measure bores from 0.275" to 8.000" . . . give readings *directly* in increments of 0.0001", 0.0002", or 0.0005" depending on size. Provide positive accuracy possible only through three-point bearing design. Write for complete illustrated Bulletin describing the new Intrimik.

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Milling Machines • Grinding Machines • Screw Machines
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Speed-up OPERATIONS with heinrich

# MEET THE CHAMP!

## UNIVERSAL DRILL BUSHINGS BEAT ALL RECORDS FOR LONG LIFE AND ACCURACY

The extremely long life of Universal Drill Bushings is due to several factors. They are machined from finest quality steel. Their superhoned bores help to reduce both wear of the bushing and wear of the tools. Blended radius on the top inside diameter helps prevent tool hang-up and breakage. 100% concentricity and hardness tests insure accuracy and uniform quality. Knurled heads provide a quick, sure grip. Available in a complete range of standard sizes and lengths. Orders for special dimensions will receive prompt attention. For complete information, write to the office nearest you—Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.—or our home office.

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**UNIVERSAL ENGINEERING COMPANY**
FRANKENMUTH 3
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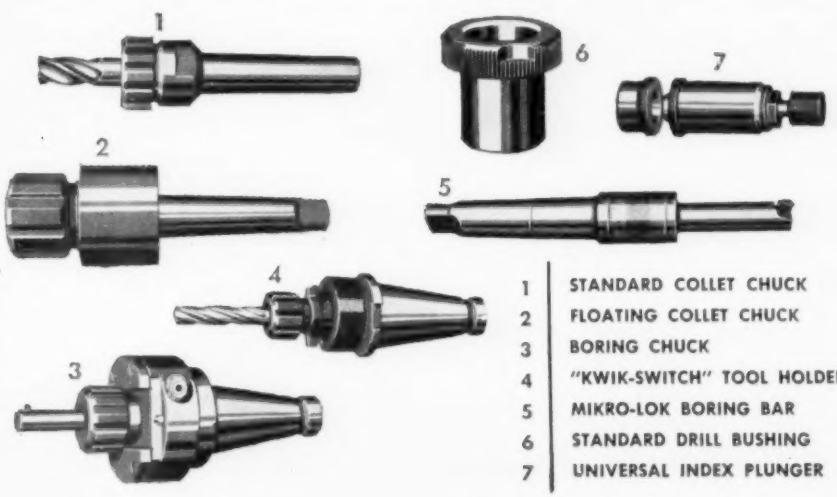


1 STANDARD COLLET CHUCK
2 FLOATING COLLET CHUCK
3 BORING CHUCK
4 "KWIK-SWITCH" TOOL HOLDER
5 MIKRO-LOK BORING BAR
6 STANDARD DRILL BUSHING
7 UNIVERSAL INDEX PLUNGER

# Glenzer Utility Tools

## Utility Sleeves

Removable Taper Shanks allow use of lower cost straight shank small tools. Ask for Data folder I-A.

## Floating Tool Holders

"GLENCO" Tool Holders compensate for misalignment up to 1/32" radius. Save set-up time —assure perfect work from worn machines. Ask for Data folder I-J.

## Precision Friction-less Live Centers

Cushioned to reduce tool breakage—Timken Roller Bearings for accuracy, long life. Ask for Data folder I-D.

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*Specialized Service*
to American Industry

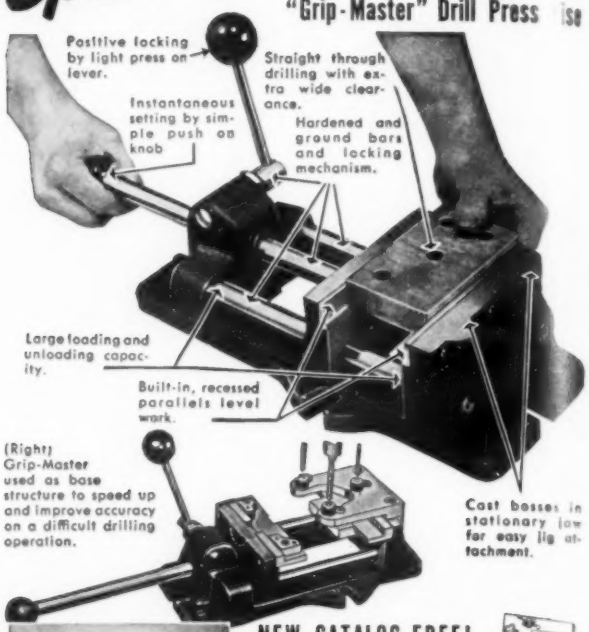
Glenzer Utility Tools have demonstrated their advantages so convincingly that they are specified as standard by more and more companies, year after year.

THE J. C. **GLENZER** CO., Inc.
1552 E. NINE MILE ROAD, DETROIT 20, MICH.

USE READER SERVICE CARD; INDICATE A-1-170-1



# Speed-up OPERATIONS with heinrich "Grip-Master" Drill Press Use


Positive locking by light press on lever.
Instantaneous setting by simple push on knob
Straight through drilling with extra wide clearance.
Hardened and ground bars and locking mechanism.
Large loading and unloading capacity.
Built-in, recessed parallels level work.


(Right) Grip-Master used as base structure to speed up and improve accuracy on a difficult drilling operation.
Cast bosses in stationary jaw for easy jig attachment.

heinrich TOOLS, INC.

**NEW CATALOG FREE!**
Be sure you have a complete Heinrich Tool Catalog in your files. Your copy will be sent free upon request.

DEPT. 184-A RACINE, WIS.
Drill Press Vises • Fixture Locks • Nibblers Punches • Rod Cutters

USE READER SERVICE CARD; INDICATE A-1-170-2



# INCREASE PRODUCTION.. SAVE TIME & MONEY ON YOUR DRILLING OPERATIONS

*PATENTED

**MEYCO**
**Carbide Inserted Bushings last longer, cost less in the long run**

Here is a bushing that combines the best features of steel and carbide; the strength of steel and the long life of carbide. First cost: slightly higher than ordinary steel bushings; their life: many, many times as great. In addition to such obvious savings, MEYCO bushings increase the life of drills and reamers, produce accurate work for a longer period of time, save on machine-down time and on nonproductive man-hours.

☆

Auto manufacturer says: "... the steel bushings previously used averaged about 28 hours life. MEYCO bushings ran 1,168 hours before they were unusable."

**For information and prices write for Meyco Bushing Catalog No. 13**

W. F. MEYERS CO., INC., BEDFORD, INDIANA

USE READER SERVICE CARD; INDICATE A-1-170-3

# Miller AIR CYLINDERS

**E PLATED**
**RODS**
ratch-Damage,
Rust

**IRT VIPER SEALS**
ds, Seals, Bushings

**OLID STEEL HEADS,**
**APS and MOUNTINGS**
iminate Breakage

**RASS BARRELS**
iminate Rust and Corrosion

WRITE FOR CYLINDER BULLETINS A-105 and H-104

Complete Miller cylinder line includes: air cylinders, 1½" to 20" bores, 200 PSI operation; low pressure hydraulic cylinders, 1½" to 6" bores for 500 PSI operation, 8" to 14" bores for 250 PSI; high pressure hydraulic cylinders, 1½" to 12" bores, 2000-3000 PSI operation. All mounting styles available.

**MET J. I. C. PNEUMATIC STANDARDS** years before their adoption in 1950.

**SPACE-SAVING SQUARE DESIGN** originated by Miller in 1945.

**SALES AND SERVICE FROM COAST TO COAST**

VELAND • YOUNGSTOWN • DAYTON • PITTSBURGH • PHILADELPHIA • TON • HARTFORD • NEW YORK CITY • BUFFALO • ST. PAUL • GRAND DS • DETROIT • FLINT • FORT WAYNE • SOUTH BEND • INDIANAPOLIS LWAUKEE • LOUISVILLE • KANSAS CITY • SEATTLE • LOS ANGELES • FRANCISCO • BALTIMORE • DENVER • ST. LOUIS • MOLINE • CHICAGO OUSTON • TORONTO, CANADA and OTHER AREAS

Miller

**MILLER MOTOR COMPANY**

2010 N. HAWTHORNE AVE. • MELROSE PARK, ILL.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

# Glenzer Utility Tools

## Utility Sleeves

Removable Taper Shanks allow use of lower cost straight shank small tools. Ask for [illegible] folder I-A.

## Floating Tool Holde

"GLENCO [illegible] Holders compens misalignment up radius. Save set- —assure perfec from worn machi for Data folder

## Precision Friction-less Live Center

Cushione duce tool brec Timken Roller I for accuracy, lo Ask for Data fol

## 35 YEARS

of

*Specialized Service*

to American Industry

Glenzer Utility Tools have demonstrated their advantages so convincingly that they are specified as standard by more and more companies, year after year.

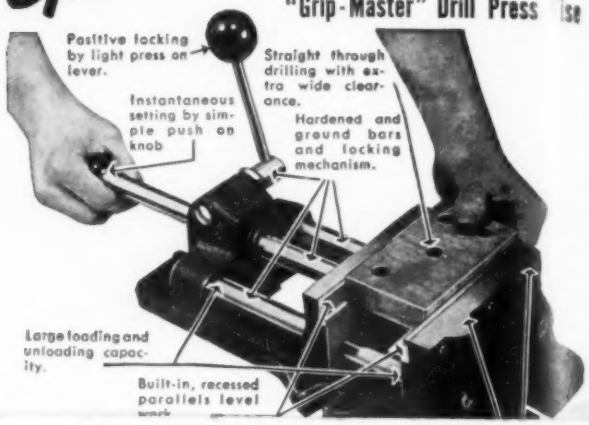
THE J. C. **GLENZER** CO., Inc.

1552 E. NINE MILE ROAD, DETROIT 20, MICH.

USE READER SERVICE CARD; INDICATE A-1-170-1



## Speed-up OPERATIO[illegible]S with heinrich "Grip-Master" Drill Press [illegible]se


Positive locking by light press on lever.
Straight through drilling with extra wide clearance.
Instantaneous setting by simple push on knob
Hardened and ground bars and locking mechanism.
Large loading and unloading capacity.
Built-in, recessed parallels level

# TIGH

# BOU

*PATENTED

**For information and prices write for Meyco Bushing Catalog No. 13**

**in the long run**

Here is a bushing that combines the best features of steel and carbide; the strength of steel and the long life of carbide. First cost: slightly higher than ordinary steel bushings; their life: many, many times as great. In addition to such obvious savings, MEYCO bushings increase the life of drills and reamers, produce accurate work for a longer period of time, save on machine-down time and on nonproductive man-hours.

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W. F. MEYERS CO., INC., BEDFORD, INDIANA

USE READER SERVICE CARD; INDICATE A-1-170-3

# Miller AIR CYLINDERS

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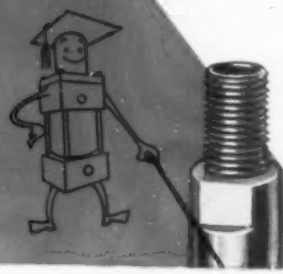

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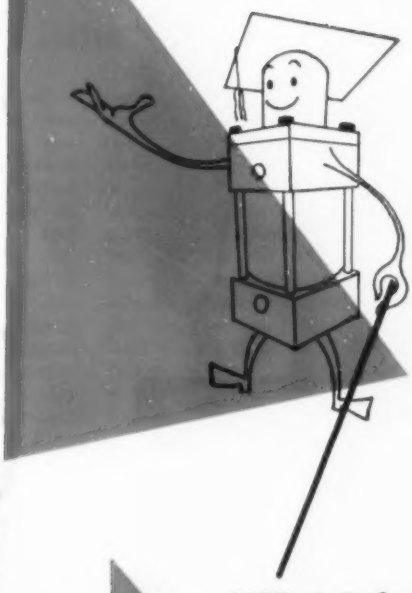

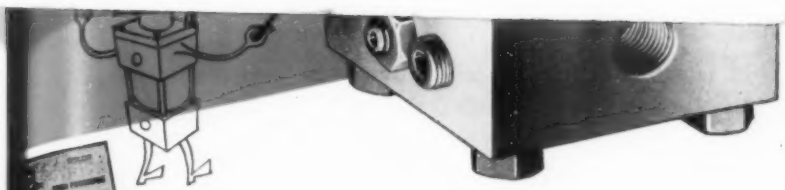

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Miller

**MILLER MOTOR COMPANY**

2010 N. HAWTHORNE AVE. • MELROSE PARK, ILL.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

# UNIFORM

As alike as two penguins — or, "two peas in a pod" . . . that's the meaning of Bath Tap uniformity.

The size of Bath Taps is absolute . . . exact duplication is assured. No need to worry — you get the same dimensions on a tap re-order . . . stock or custom built . . . next week or next year.

Uniform manufacture is guaranteed — all Bath Tap measurements are "controlled", including pitch, major and root diameters, shank and pointing — all are concentric with the axis of the tap. Grinding is done while the tap is mounted on center holes . . . precisioned *after the tap is hardened.*

Bath engineering records preserve for ready reference, a wealth of case history experience in tap design, heat treatment, finishes and operative details on thousands of Bath Taps of all types and sizes.

Bath sales representatives are quite apt to have the answer to your threading problem at their fingertips. This much is for sure . . . once your problem is solved, you can depend on Bath Taps to be **UNIFORM** in manufacture and performance.

Bath engineers check every detail, to see that all Bath Taps are conditioned to do the best threading job for your requirements.

*Insist on BATH TAPS for BETTER THREADS*

**JOHN BATH & CO., Inc.**
**28 Grafton St., Worcester, Mass.**

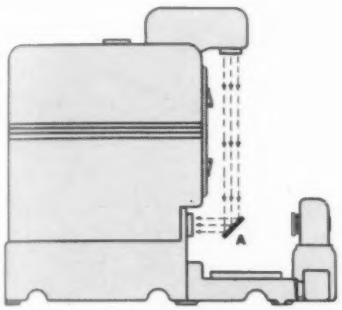
PLUG AND RING THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS

## ...lain Pointers on Projection

AM...NG the definitions listed by Webster for the adjective *universal* is: "adapted or adaptable to all or to various uses, sizes, shapes, et cetera"—a definition we like to feel applies to Kodak Contour Projectors.

Admittedly, we make two projectors, one for routine inspection gaging (the low cost of which might surprise you) and a second for toolroom use affording measurements to "tenths." Optically, however, these two instruments are one. And it's their optical system which makes them truly "universal."

Back in the early days of design, our engineers set out to provide in a single contour projector light sources both for horizontal and for vertical shadow projection. They also developed the unique Kodak Surface Illuminator, a self-contained light source which affords surface projection in either plane. Their reasoning was economic. By combining these features, the instrument could be easily adapted to a wide range of parts; the more uses to which the projector might be put, the sooner it would pay for itself in the shop.

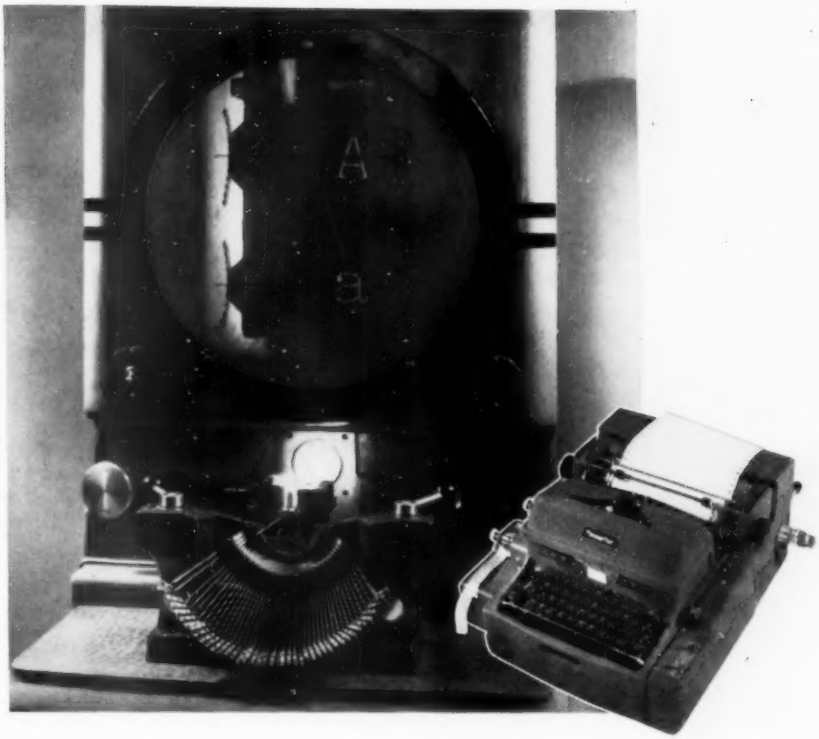



Above drawing illustrates how vertical light source is utilized. With part on a glass staging platform, image is reflected by mirror (A) into optical system of projector.

Nothing has happened since the design stage to shake us in this belief. However, we have been somewhat surprised by some of the highly ingenious ways in which our projectors are used: as in the case of the typewriter fixture (illustrated in our advertisement at the right), where the surface illuminator yields a simultaneous plan and profile view of the type bar face.

Equally ingenious, if not more so, is a device which employs both the horizontal and vertical light beams to simultaneously project the shadow image of a shaft and a reticle scale for gaging its tolerances. A description of this application, which runs to more words than space here affords, is available on request from the Special Products Sales Division, Eastman Kodak Company, Rochester 4, N. Y. Just ask for the folder on the new, universal shaft checking fixture.

Applications such as these have opened the eyes of many engineers to the fact that inspection by optics today has overcome traditional limitations. In the best sense of Webster, contour projection may be "adapted to various uses, sizes, shapes, et cetera." And to the solution of various problems in inspection and precision measurement, including, perhaps, your own.

## This "3-D picture" showed the way to cut aligning time 25%

What you see here on the Kodak Contour Projector is both the *front* and *side* view of a typewriter type bar—a picture that helped reduce aligning time 25% at Commercial Controls Corp., manufacturers of tape-controlled Flexowriters and Justowriters.

Light reflected from the surface of the type character provides an image for rapidly checking horizontal and vertical alignment of the letter. Simultaneously, mirrors in the special holding fixture project a profile image of the type—yield an accurate check of the desired position of the letter as it will contact the platen. Only the Kodak Contour Projector's unique surface illuminator makes possible this combined plan and profile view.

Alignment of type is a critical factor on these automatic machines which type at 100 words a minute and must produce copy for printing reproduction. Until recently, Commercial Controls had to perform this inspection operation during final assembly. Now, this new gaging technique has made it possible to inspect the type bars immediately after their removal from the soldering jigs. Each bar is quickly moved into place and compared with the tolerance lines of the chart-gage on the screen. Alignment of letters is held to a tolerance of ±.0002", contact to ± .0015". And, by catching errors at this point, aligning time has been cut 25%.

Perhaps the speed, precision, and economy of optical gaging can help you solve a difficult inspection or measurement problem. There is a field representative in your area who will be glad to discuss your problem with you. You can get in touch with him or obtain a copy of the booklet, "The Kodak Contour Projector," by writing to:

**Special Products Sales Division**
**EASTMAN KODAK COMPANY**
**Rochester 4, N. Y.**

**the KODAK CONTOUR PROJECTOR**

Optical Gaging

A new sound movie, Optical Gaging, shows how to simplify complex inspection problems. We'll tell you how to get it for a showing.

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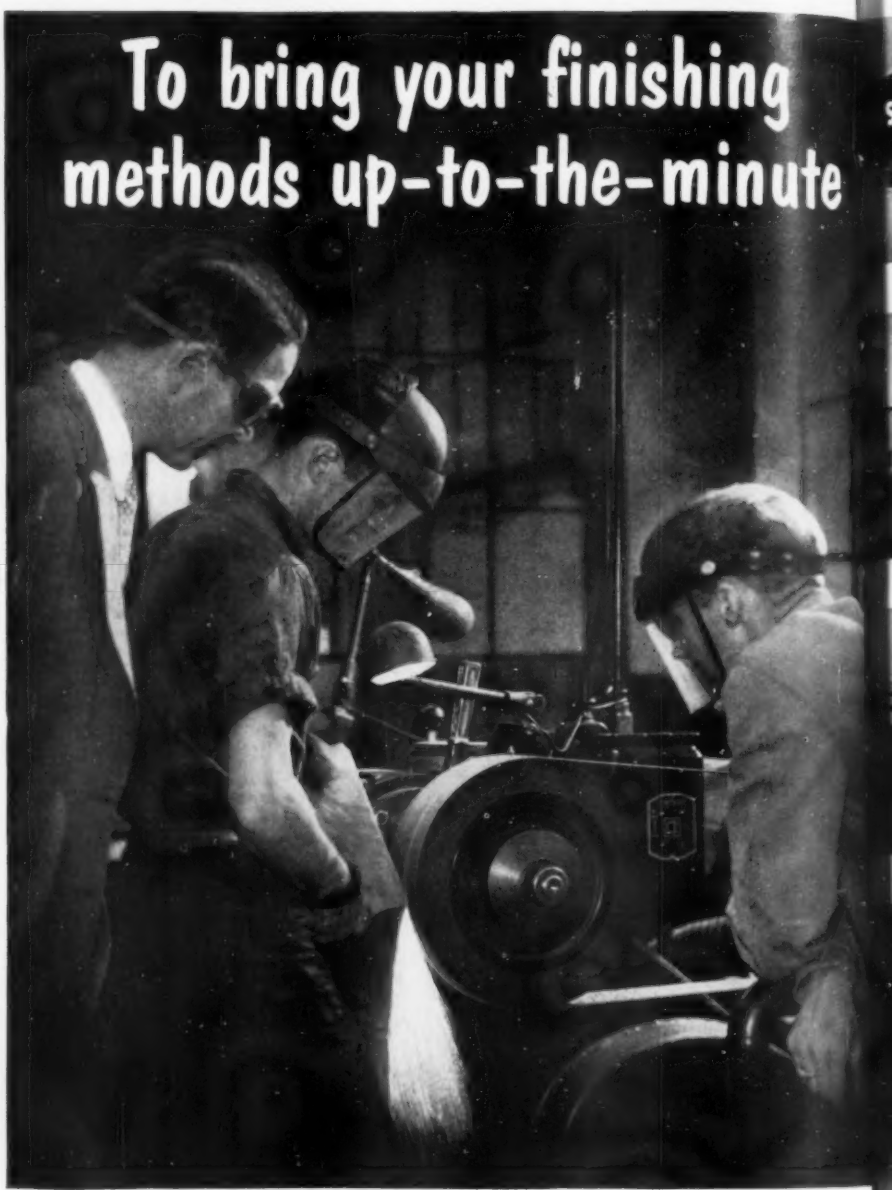
HIGH POINT

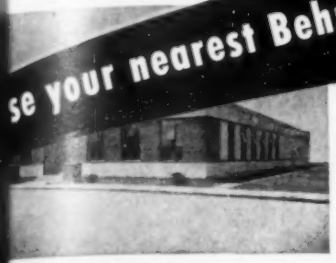


GRAND RAPIDS

DETROIT

ATLANTA

# se your nearest Behr-Manning abrasive belt "production laboratory"



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**On typical pieces of your own production,** try out the latest developments in abrasive belt applications. Utilize the specialized skill of BEHR-MANNING Engineers, plus the constantly improving results of BEHR-MANNING research. All this is available to you at no cost, in your nearest BEHR-MANNING Methods and Equipment Demonstration Room — actually a proving ground for production.

**Sixteen strategically located branches** now have these BEHR-MANNING "production laboratories," all completely equipped, operating with the sole aim of insuring you the greatest possible economies in belt application. Considering the recent rapid advances in this field, a visit to your local Demonstration Room may very well be the basis for decidedly worthwhile savings, better finishes, or both. Make an appointment by phone, or write us direct.

For interesting data on new belt methods, write for the booklet, "How Polisher Pete Put Economy in Polishing." Address Behr-Manning Corp., Troy, N. Y., Dept. TE-1.

In Canada: Behr-Manning (Canada) Ltd., Brantford.
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BEHR-MANNING® CORPORATION *division of NORTON Company*

▲ COATED ABRASIVES
▲ SHARPENING STONES
▲ PRESSURE-SENSITIVE TAPES

G-5

***For the newest in coated abrasives...watch Behr-Manning!***

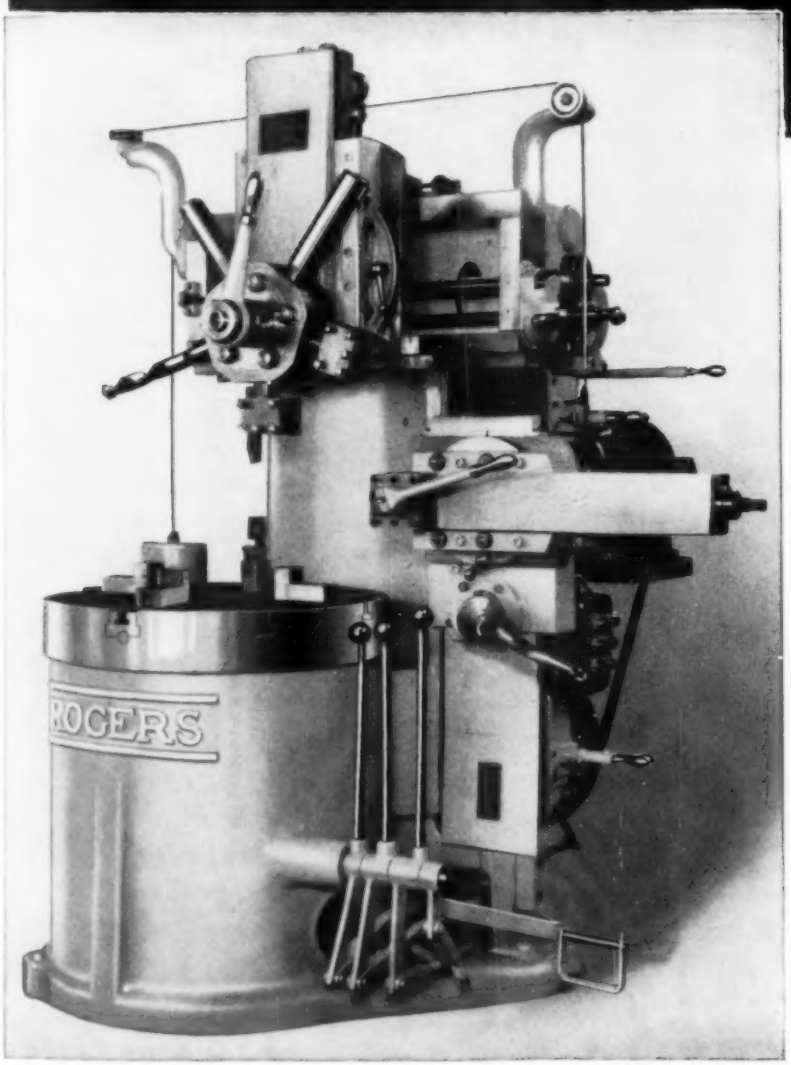
# UNBELIEVABLE

## *So Much For So Few $ $ $ $ $ $*

# ROGERS *"perfect 36"*

## VERTICAL TURRET MILL

only $9630.00




ROGERS has a background of over 65 years of engineering "know-how" and built-in precision quality.

●

ROGERS "Perfect 36" Vertical Turret Mills are used on production lines and in maintenance departments by many leading manufacturers in the United States, Canada and around the world. 28 in one plant.

●

By standardizing on one size and type mill ROGERS "Perfect 36" Vertical Turret Mills are made with production line economies which are reflected in the low price.

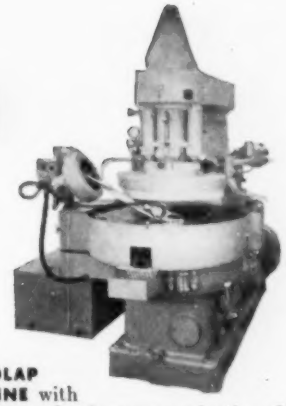
●

*Write for Catalog TODAY*

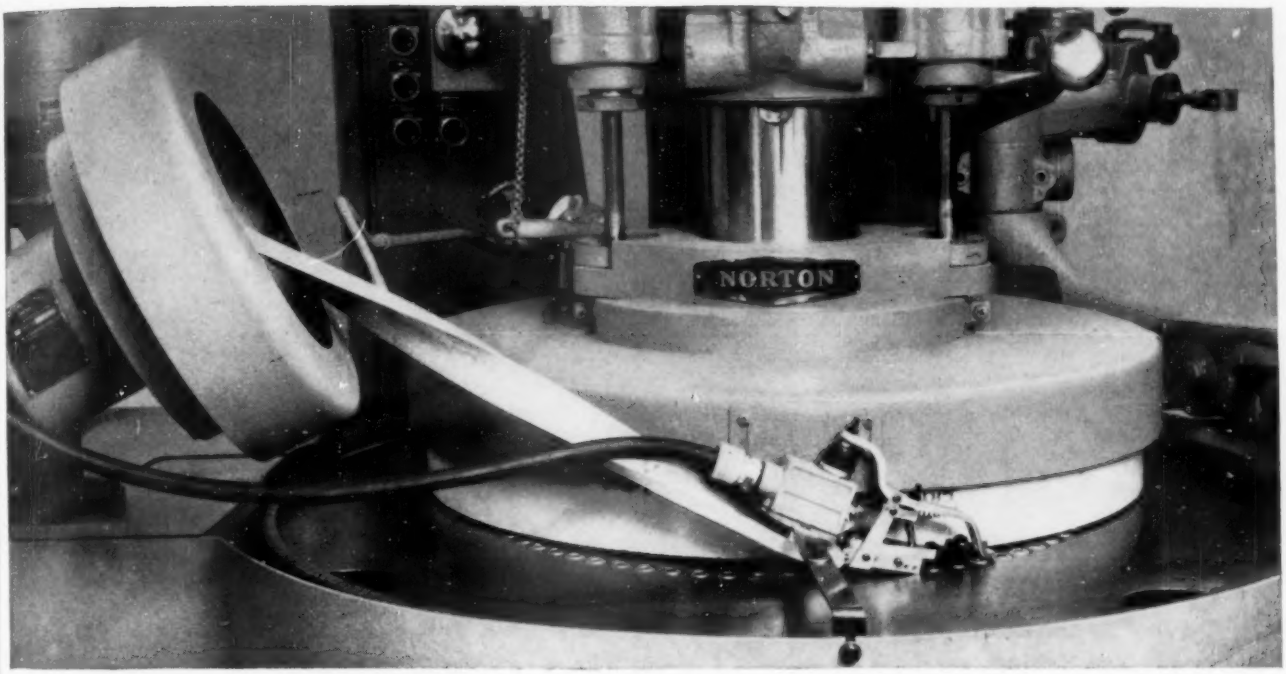
## ROGERS MACHINE WORKS, 1412 Seneca St., Buffalo 10, N.Y.

*Knowing how since 1885*

# Norton Thru-Feed Lapper gives you the "TOUCH OF GOLD" for small, flat parts



**NORTON 26 HYPROLAP LAPPING MACHINE** with automatic loading features that increase production of small, flat parts difficult to handle manually as much as 4 to 1 . . . as many as 8000 pcs/hr.




**AUTOMATIC LOADING ARRANGEMENT** of Norton 26 Hyprolap lapping machine makes sure parts are in correct position before entering feeding trough . . . prevents ganging up . . . directs work in a path that assures even lap wear.

## NEW, built-in automatic loading adds extra advantages to Norton 26 Hyprolap*

You can make 4-to-1 savings in lapping small, flat parts . . . by adding the "Touch of Gold" that adds to profit by cutting costs. Investigate new Norton 26 Hyprolap lapping machines with the exclusive built-in thru-feed mechanism.

Here's why:

1. **You speed up production.** Loading and lapping operations handle parts as fast as 8,000 pieces per hour.
2. **You cut handling.** Loading and unloading are completely automatic.
3. **You reduce downtime.** Work path traverses the entire working surface of each lap . . . promoting even wear . . . reducing the frequency of lap dressing.
4. **You cut out operations.** This lapper removes stock down to .0002" tolerances . . . makes surfaces parallel to .000025" . . . in many instances without pre-grinding of parts.
5. **You use less skilled help.** Filling feed hoppers and removing finished-work baskets are the only manual operations.

*No wonder 4-to-1 savings are a matter of record with the new Norton Hyprolap with built-in automatic loading!*

Send for Bulletin 852-7. Also submit samples of your work for production estimates. Standard hopper-feed Hyprolap machines take work up to 1¼" diameter. Modifications handle larger work. NORTON COMPANY, Machine Division, Worcester 6, Mass.

*Trade-Mark Reg. U. S. Pat. Off.

*To Economize Modernize With* **NEW**

**NORTON**

**GRINDERS and LAPPERS**

*Making better products to make other products better*

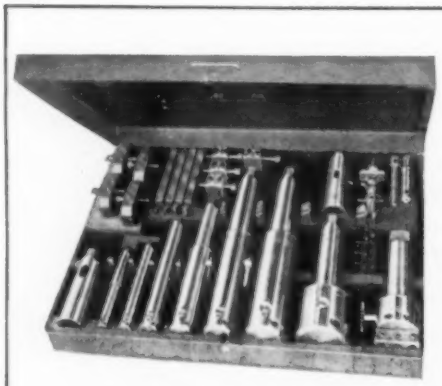
District Sales Offices: Hartford • New York • Cleveland • Chicago • Detroit

**Davis "Super Micrometer" stub boring tool sets give you greater machine use by eliminating cut-and-try boring. They are extremely rugged, adjustable to .0001 in.**

With these handy, production-boosting tool sets you have high precision tools for handling heavy boring assignments from ⅜ to 7 in. diameter . . . light, extended boring up to 13 in. diameter.

Available for almost immediate delivery, these sets are all equipped with high-speed steel cutters. Stellite, super-high-speed steel or tungsten-carbide tipped cutters can be furnished upon request. Some sets include offset boring heads, pencil boring heads and reducing sleeves . . . plus setup items such as parallels, adjustable stop jacks and T-slot parallel blocks.

See your representative or write for details.



Set No. 11 (illustrated) contains seven stub boring tools covering a boring range from 1½ to 7 in. It is one of the ten complete, convenient, standard sets for you to choose from.

Modifications in any set can be made to meet your exact requirements.

*If Davis can't bore it — it can't be done*

**Davis Boring Tool Division**

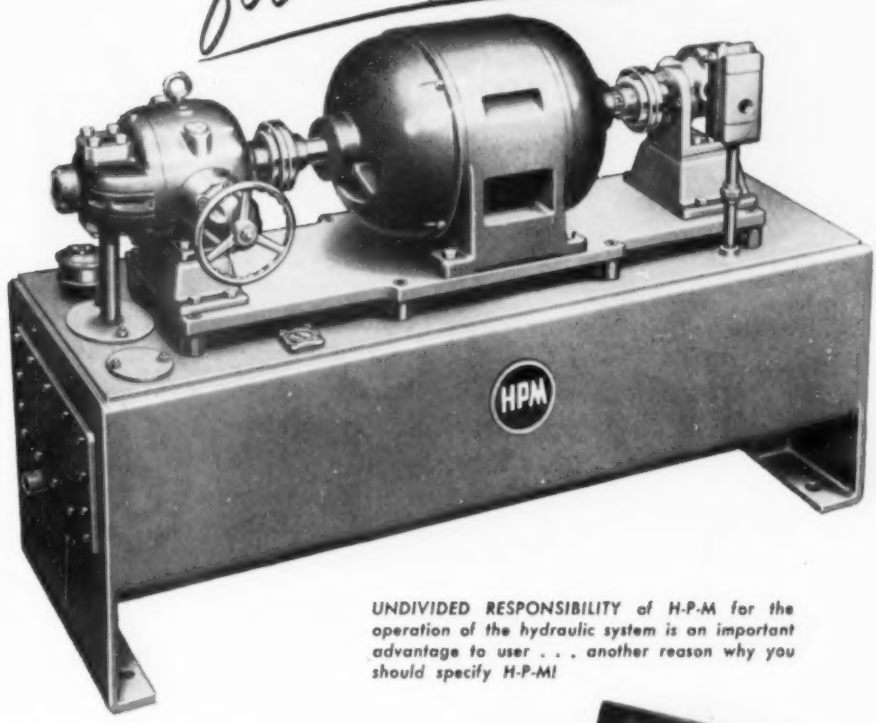
GIDDINGS & LEWIS MACHINE TOOL COMPANY

FOND DU LAC, WISCONSIN

Builders of plain and micrometer adjustable block type boring tools; line boring bars; special boring tools; car boring tools; planer, vertical boring and turning mill tools; Quick Change arbors and sleeves.

# POWER UNITS

*for every need*




*UNDIVIDED RESPONSIBILITY of H-P-M for the operation of the hydraulic system is an important advantage to user . . . another reason why you should specify H-P-M!*

Completely self-contained "packages" of hydraulic power conforming to J. I. C. standards.

Reservoir capacities 10 to 225 gallons.

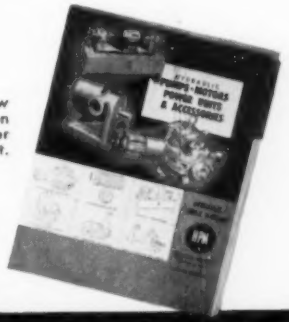
H-P-M Power Units include all necessary pumps, valves, oil filters, strainers, air cleaners, oil level gauges, piping and heat exchangers where required.

Compact, modern design with all parts readily accessible for easy maintenance.

Many combinations of H-P-M variable and fixed displacement pumps offer variety of volume and pressure ranges for every requirement.

H-P-M Power Units pre-tested and ready for immediate operation.

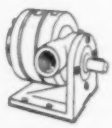
...Write for H-P-M's new fact-filled catalog on Pumps, Motors and Power Units . . . ask for Cat. No. 601 TODAY!



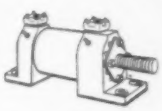
ACCESSORIES

VALVES

PUMPS & MOTORS



CYLINDERS



HYDRAULIC POWER DIVISION

THE HYDRAULIC PRESS MFG. CO.

MOUNT GILEAD, OHIO, U. S. A.

2004 Marion Road

**A Factor in the Field of Hydraulics Since 1877!**

## ONE SOURCE FOR ALL COMPONENTS!

# COST REDUCTION

thru *faster* continuous broaching of multiple parts

• Wherever metal is removed on duplicate small parts you are apt to find a place where Footburt Surface Broaching Machines can cut manufacturing costs. Production is high, and tool maintenance is low in cost per piece. We have had many years of experience in designing the tooling for various types of parts and will gladly advise you in applying surface broaching to your work.

**THE FOOTE-BURT COMPANY • Cleveland 8, Ohio**

Detroit Office: General Motors Building

• Holding fixtures are designed for quick, convenient loading, with automatic clamping and unclamping.

# FOOTBURT

## MACHINE TOOLS

# NEW – DIFFERENT

## 4-POST DRILLER AND TAPPER

## 26 Individual Machine Operations in one unit!

Once again BAUSH ingenuity and experience of many years has produced an hydraulic automatic multi-spindle machine tool designed specifically to speed production on Tank Engine oil pans.

**SPECIFICATIONS:**

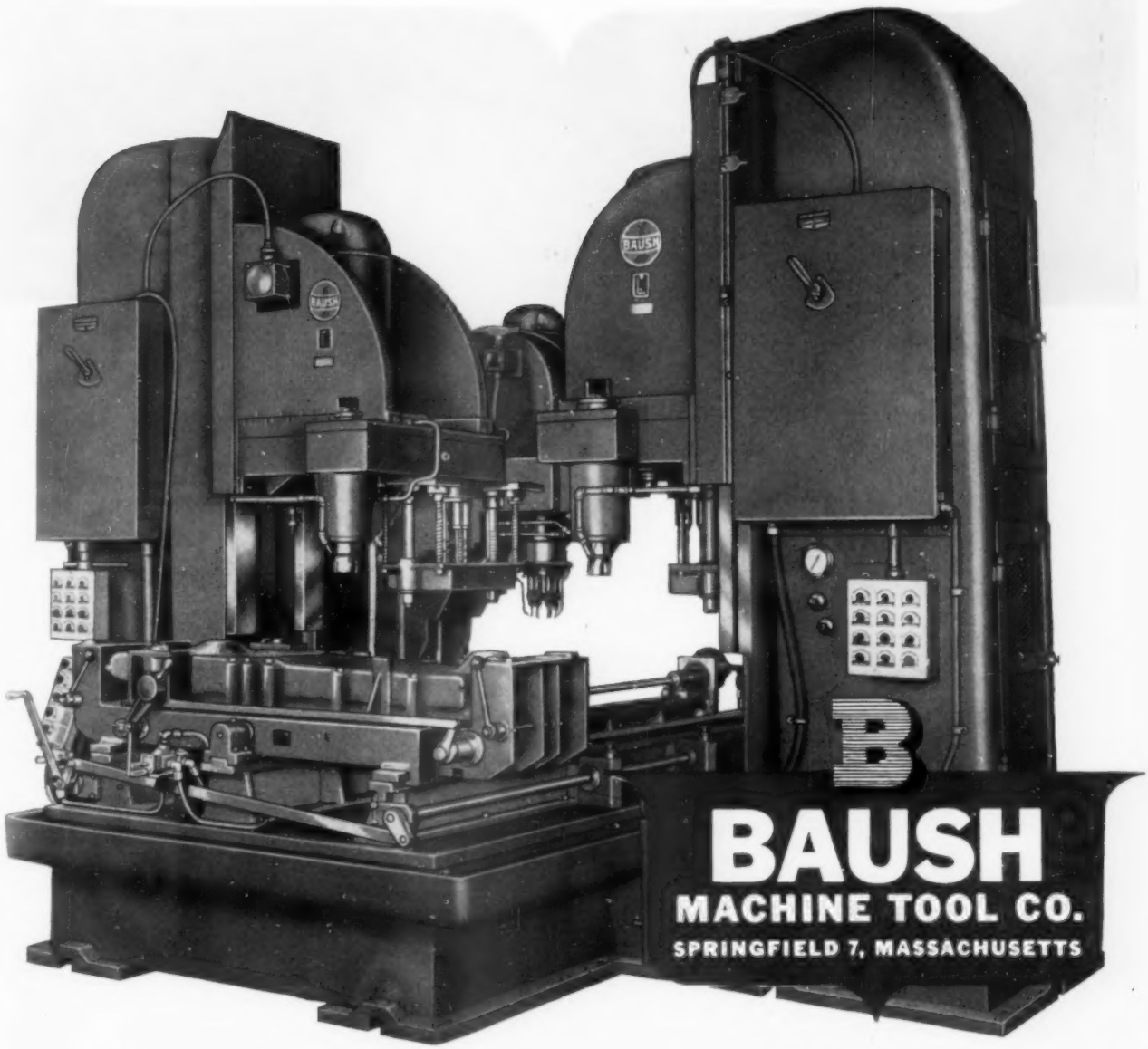
This 4-Way, 4-Post Combination Drilling and Tapping Machine consists of 2 Vertical W-7 Hydraulically operated units. Each unit has a 7 spindle, fixed center, ball-bearing head and two welded steel columns, each with 6 individual lead-screw spindle heads.

Hydraulically operated fixture is a 4-station horizontal duplex set up mounted on large welded steel bed, around which the four vertical machines are built. Steel ways are hardened and ground.

**OPERATIONS:**

Parts: Tank engine oil pan.
Part lowers into slide with a hoist.

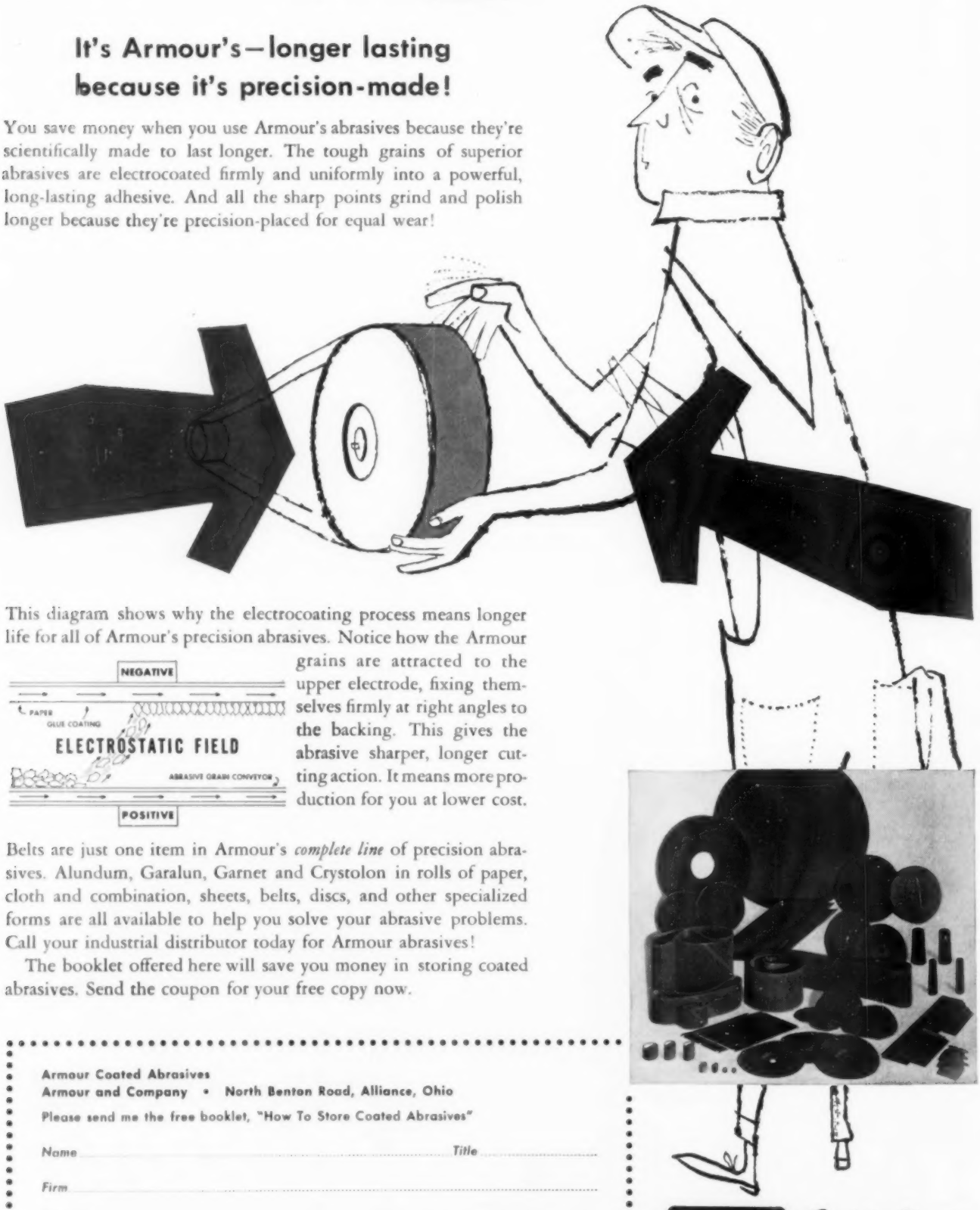
| | |
|---|---|
| Station 1: | Load and unload. |
| Station 2: | Core bore 2 holes. |
| Station 3: | Combination drill and countersink 12 holes. |
| Station 4: | Tap 12 holes. |



# Don't change that belt!

## It's Armour's—longer lasting because it's precision-made!

You save money when you use Armour's abrasives because they're scientifically made to last longer. The tough grains of superior abrasives are electrocoated firmly and uniformly into a powerful, long-lasting adhesive. And all the sharp points grind and polish longer because they're precision-placed for equal wear!



This diagram shows why the electrocoating process means longer life for all of Armour's precision abrasives. Notice how the Armour grains are attracted to the upper electrode, fixing themselves firmly at right angles to the backing. This gives the abrasive sharper, longer cutting action. It means more production for you at lower cost.




Belts are just one item in Armour's *complete line* of precision abrasives. Alundum, Garalun, Garnet and Crystolon in rolls of paper, cloth and combination, sheets, belts, discs, and other specialized forms are all available to help you solve your abrasive problems. Call your industrial distributor today for Armour abrasives!

The booklet offered here will save you money in storing coated abrasives. Send the coupon for your free copy now.

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ARMOUR *Coated Abrasives*

Armour and Company • Alliance, Ohio

# HE INGERSOLL CUTTER GRINDER

# *Improved*

. . . MORE POWER FOR FASTER ROUGHING
. . . EASIER TO OPERATE
. . . LESS MAINTENANCE

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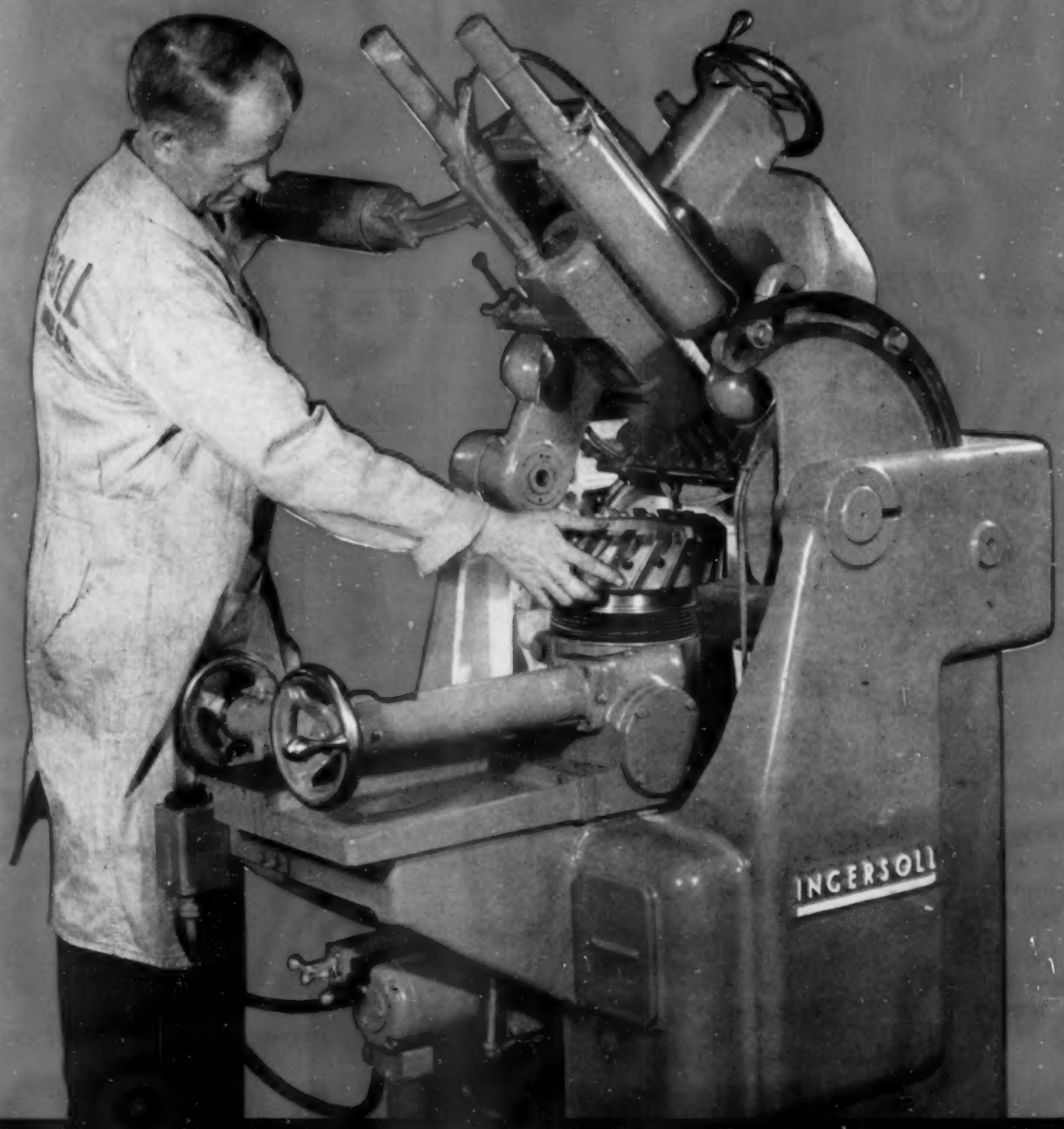
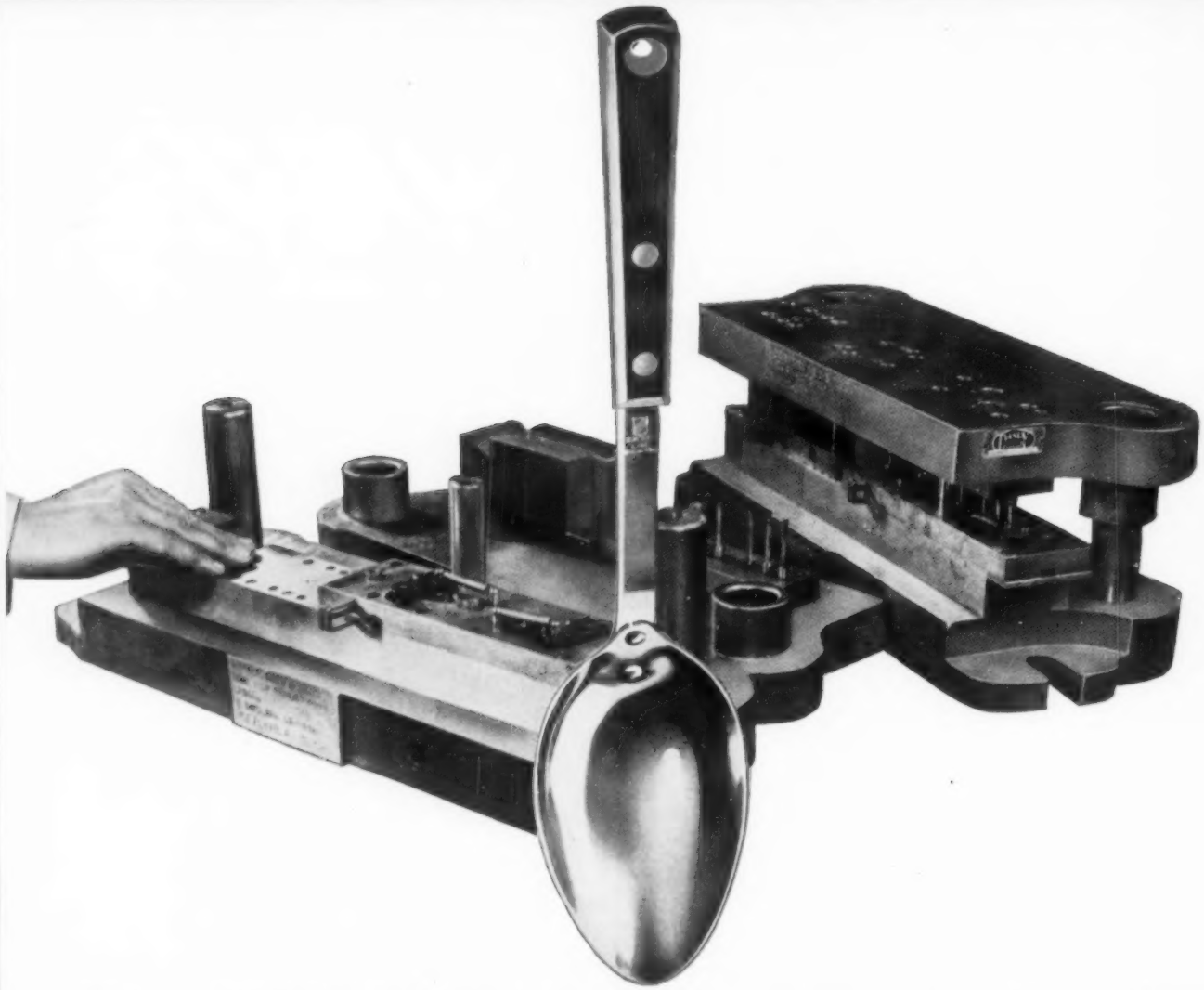
THE INGERSOLL MILLING MACHINE CO. • ROCKFORD, ILL.

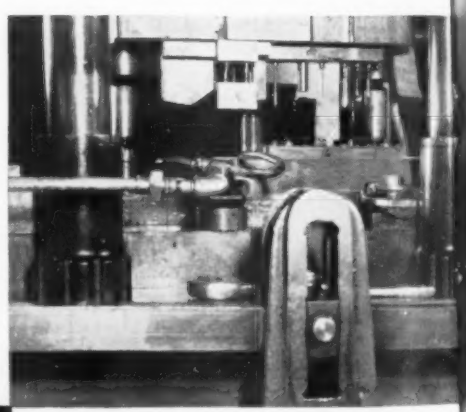




# Ekco DEPENDS ON DANLY to save tooling time!

This popular basting spoon is one of thousands of famous household items made by Ekco Products Company in dies mounted in Danly Die Sets. Ekco depends on Danly Die Sets to save costly tooling time and help maintain uninterrupted production schedules in this highly competitive industry, because Danly Die Sets provide the finest *precision* starting point for diemaking. They are available on short notice from a completely stocked Danly assembly plant nearby.

It's a point worth remembering . . . when the job calls for *precision* performance, *depend on Danly Die Sets!* There's a Danly Branch near you . . . stocked for immediate delivery.



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| ***CLEVELAND** | 14 | 1550 East 33rd St. |
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| ***DETROIT** | 16 | 1549 Temple Ave. |
| ***GRAND RAPIDS** | | 113 Michigan St., N.W. |
| **INDIANAPOLIS** | 4 | 5 West 10th St. |
| ***LONG ISLAND CITY** | | 47-28 37th St. |
| ***LOS ANGELES** | 54 | Ducommun Metals & Supply Co., 4890 South Alameda |
| **MILWAUKEE** | 2 | 111 E. Wisconsin Ave. |
| ***PHILADELPHIA** | 40 | 511 W. Courtland St. |
| ***ROCHESTER** | 6 | 33 Rutter St. |

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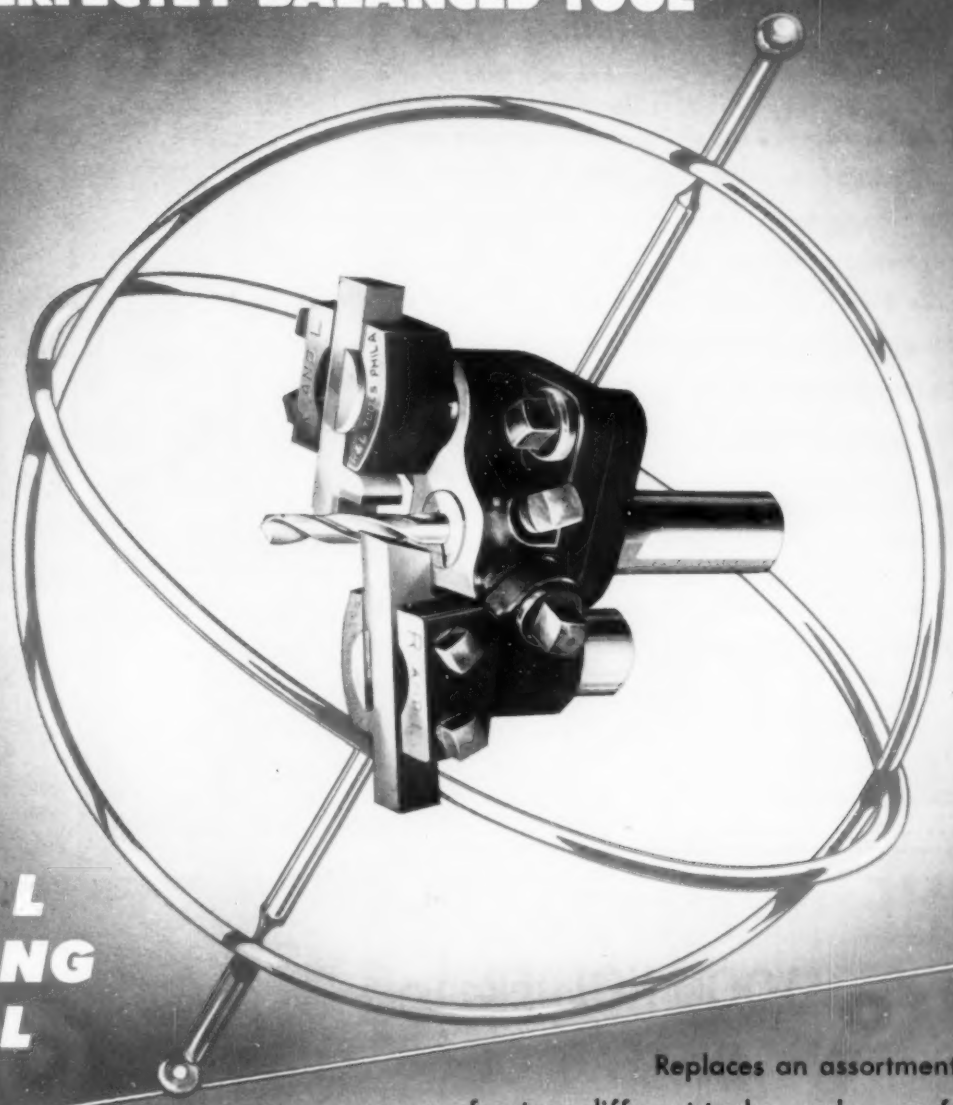
**DANLY**

DIE SETS . . . STANDARD OR SPECIAL
DIEMAKERS SUPPLIES

**DANLY MACHINE SPECIALTIES, INC.**
2100 South Laramie Avenue
Chicago 50, Illinois

# THE PERFECTLY BALANCED TOOL



## R and L TURNING TOOL

Replaces an assortment of fourteen different tools . . . changes from right to left in ten seconds . . . no misalignment . . . extremely fine adjustment provided . . . for rough and heavy cuts as well as finishing cuts . . . The R and L TURNING TOOL is constructed with best possible care and of finest steel.

*Write for Catalog*

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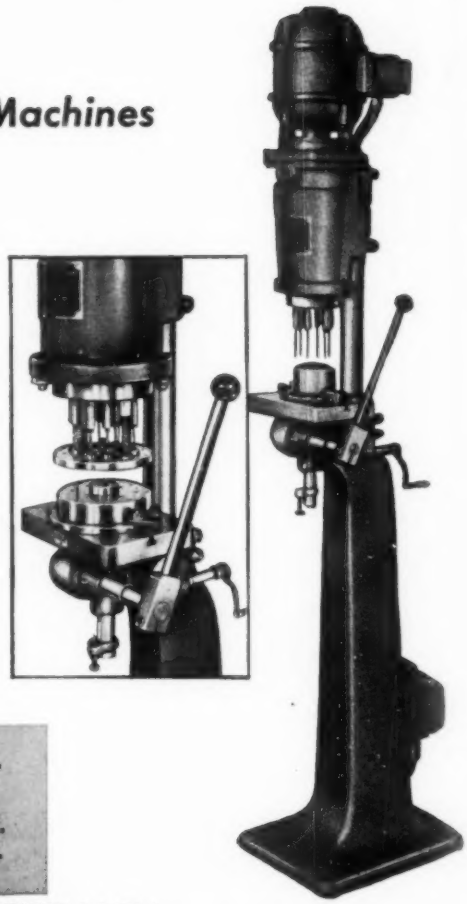
TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS, (ALSO FURNISHED FOR ACORN DIES) • UNIVERSAL TOOL POST • TURRET BACKREST HOLDER • CUT-OFF BLADE HOLDER • RECESSING TOOL • REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

**STEINEL**

## *Multi-Spindle Drilling and Tapping Machines*

***Available in Bench or Stand type***



Widely used in the manufacture of electrical apparatus, small precision parts, and particularly useful in the optical and clock industries . . . Preferred because careful construction and quality materials result in extremely accurate performance!

Precision work is guaranteed by the use of hardened drill guides. For tapping operations an automatic switch is fitted to reverse the spindles at a predetermined point so that tapping depth is accurately held.

**PARTIAL SPECIFICATIONS**

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|---|---|
| Drill stroke | 1½" |
| Spindle speeds | 355-1400 rpm |
| Max. drilling dia. | 4⅛" |
| Motor | ⅓ HP |

***PROMPT DELIVERY***

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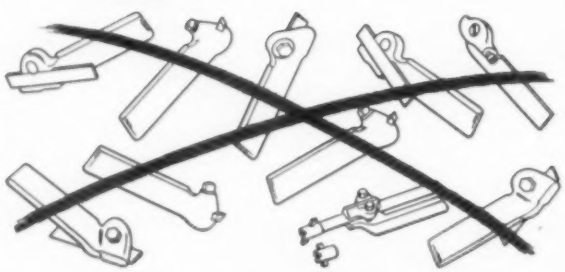
**ONE ALL PURPOSE TOOL HOLDER INSTEAD OF TEN**



**ONE tool holder for all positions—No tool chatter—can do internal boring or internal threading—Ideal for carbide tools—Bit sizes: ¼", 5/16", ⅜", 7/16", ½", ⅝".**

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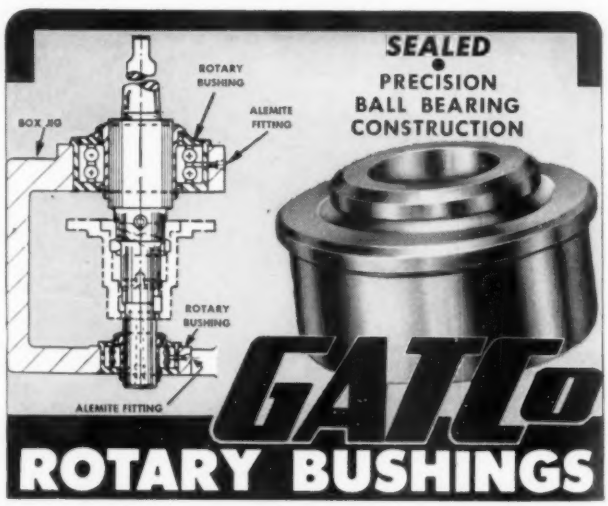


***FOR DRILLING, CORE DRILLING, ROUGH AND FINISHED BORING***

The inner race of the GATCO bushing rotates with the tool, piloting the tool accurately below or above the work—or both.

Eliminates expensive tool construction—Reduces tool wear—Prevents seizure and pilot breakage—Especially adapted where precision is required.

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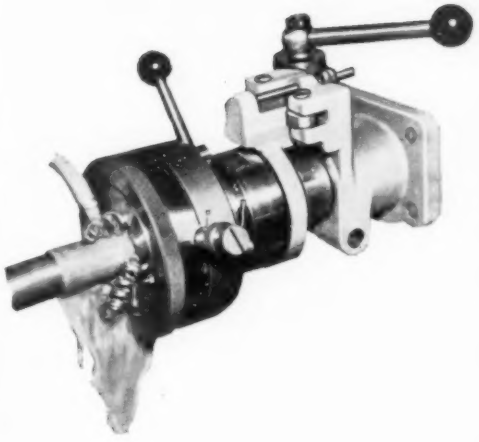

# HOLDERS

## for Jones & Lamson Die Heads

The best of Die Heads deserves the best of holders. With these holders, the extreme accuracy of your J&L Die Heads is reflected in the quality of the threads they produce. Holders for J&L Die Heads are available for most makes of turret lathes. Mail this coupon for a copy of the new illustrated catalog.

*LEVER OPERATED DIE & TOOL HOLDERS*
for more sensitive control. Eliminate side trimming. Hold reamers, taps and small drills.

*FLANGE TYPE HOLDERS*
ideal for threading long work that must pass through the face of the turret.

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for smooth, shock-free starting, better finish threads.

**Jones & Lamson Machine Company**
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*Please send Catalog No. 504 "Holders for J & L Die Heads".*

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ONES & LAMSON

*Machine Tool Craftsmen Since 1835*

JONES & LAMSON MACHINE COMPANY
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*HARD . . .*
*tough . . .*
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Hole tapered to eliminate slug jamming. Sizes in stock to match punch sizes.

**Write TODAY for your copy of handy data sheets covering specifications and prices; also name of distributor in your area.**

***Exclusive distributor wanted for the states of Washington and Texas.***

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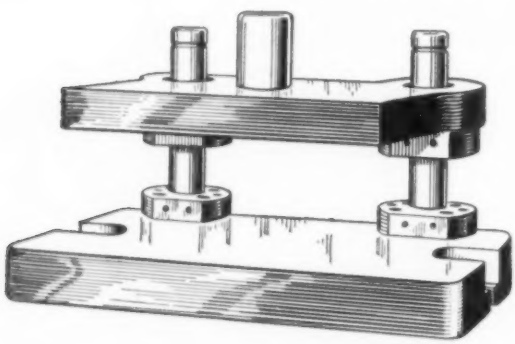

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***The OLDEST Die Set Manufacturer . . . The NEWEST Die Set Design***

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**BARNES HACK SAWS — BAND SAWS BARNES**

# BARNES WELDED BAND SAWS ARE SUPERIOR!

Barnes Band Saws are available 3 ways: Welded Bands, Arc Line 100-foot Coils, Random Economy Coils.

## LOOK AT THESE BARNES *Features . . .*

- **Special equipment assures perfect welds.**
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- **Tailor-made to exact length—NO SCRAP.**
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**DETROIT BARNES U.S.A.**

## W. O. BARNES CO., INC.

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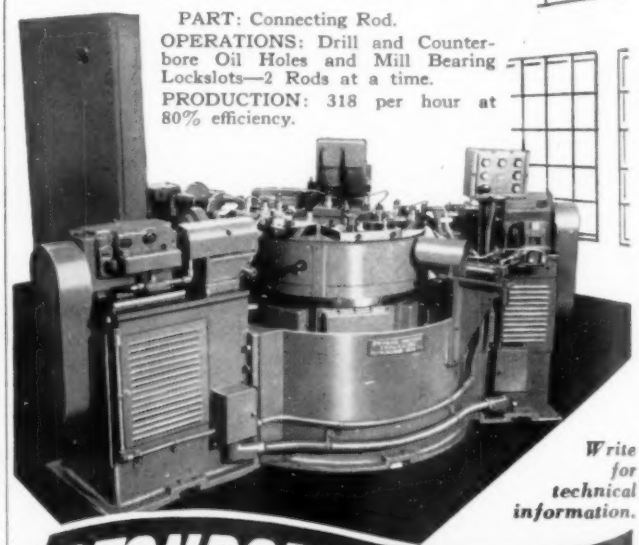
No. S. O. 4612: 4-Way, 5-Station, Hydraulic Drilling, Counterboring and Milling Machine equipped with a 36" diameter Hydraulic Index Table on which is mounted five 2-position fixtures employing automatic clamping and unclamping. At Stations 2, 3, and 5 are Hydraulic Drill Units, each with 2-Spindle Drill Heads, while at Station 4 is a Hydraulic Way Type Unit with a 2-Spindle Milling Head. All units of the machine are electrically interlocked for control of cycle.

PART: Connecting Rod.
OPERATIONS: Drill and Counterbore Oil Holes and Mill Bearing Lockslots—2 Rods at a time.
PRODUCTION: 318 per hour at 80% efficiency.



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## STANDARD MACHINE AND TOOL CO., LTD. WINDSOR, ONT.

***U.S.A. Sales Representative***
**ARNOLD J. WERNER CO.**
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**Detroit 2, Michigan**

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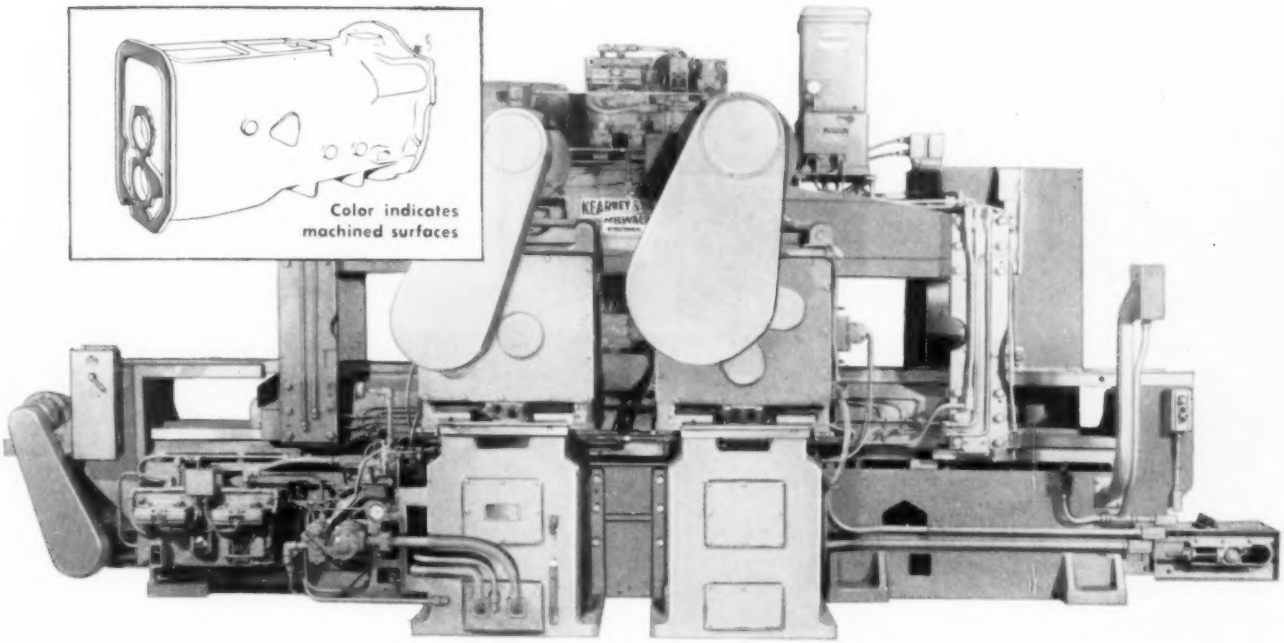
# What a saving...

Builders of Precision and Production Machine Tools since 1898




## For the customer . . . it combined four milling operations in one machine!

THIS special 6-spindle transfer type milling machine was designed and built to keep a tractor manufacturer's production line rolling at high speed. The machine now mills opposing end faces of tractor transmission cases both flat and parallel . . . to close tolerances (.002) . . . in only 94 seconds.

**FOUR HYDRAULICALLY RETRACTING HEADS** . . . First two heads have two spindles each for roughing. Second two heads have one spindle each for finishing.

**CLAMPING MECHANISM** . . . Large hollow workpiece is secured at each machining station by a tunnel-type hydraulic equalizing clamping fixture. This eliminates the distortion usually encountered when clamping this type of workpiece.

If you have problems that require special machinery—contact your Kearney & Trecker representative.

**Capacity . . . Experience . . . Performance**

Upon completion of this $5,200,000 expansion of our Special Machinery Division, we offer you (1) unmatched facilities, (2) experience based upon more than 50 years in the design and production of special machinery, and (3) performance, best recommended by our outstanding record of successfully solving many hundreds of unusual machining problems.

For more details on this machine . . . ask for *Data Sheet No. 1002.* Free booklet, "Doorway to a proven method for solution of big and small metalworking problems" is also yours for the asking. *Write today to* SPECIAL MACHINERY DIVISION, KEARNEY & TRECKER CORP., 6784 West National Ave., Milwaukee 14, Wisconsin.

**KEARNEY & TRECKER CORP. · *Special Machinery Division***

MILWAUKEE 14, WIS., U. S. A.

# "Who builds your 'CUSTOM' cylinders?"

## "HANNIFIN DOES . . . AND THEY DESIGN THEM, TOO!"

Yes, Hannifin designs and builds custom cylinders to the exact—and often extraordinary—specifications of manufacturers in many fields. (See chart at right for typical examples.)

Experienced buyers know that custom cylinders offer these distinct advantages. One, custom cylinders will exactly fit a given space or perfectly mate with another part. Two, custom cylinders may be designed for special operating conditions. Third, custom cylinders, when used in quantity, frequently cost less money.

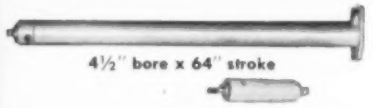
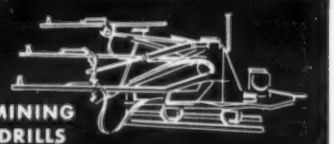
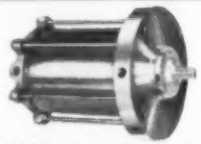
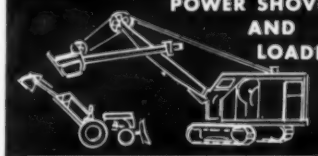
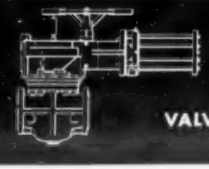
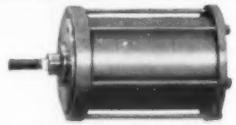
Why not have your design engineers consult with Hannifin. The Hannifin line of standard hydraulic cylinders is the most complete in the industry. Hannifin, with its broad experience, has the knowledge either to recommend the correct standard cylinder for your machines, or to design and build a quality custom cylinder at lowest possible cost.

*See your Hannifin Sales Engineer . . . or write for information—*

# HANNIFIN

**Hannifin Corporation, 1119 S. Kilbourn Ave., Chicago 24, Ill.**

**Air and Hydraulic Cylinders • Hydraulic Power Units**
**Pneumatic and Hydraulic Presses • Air Control Valves**

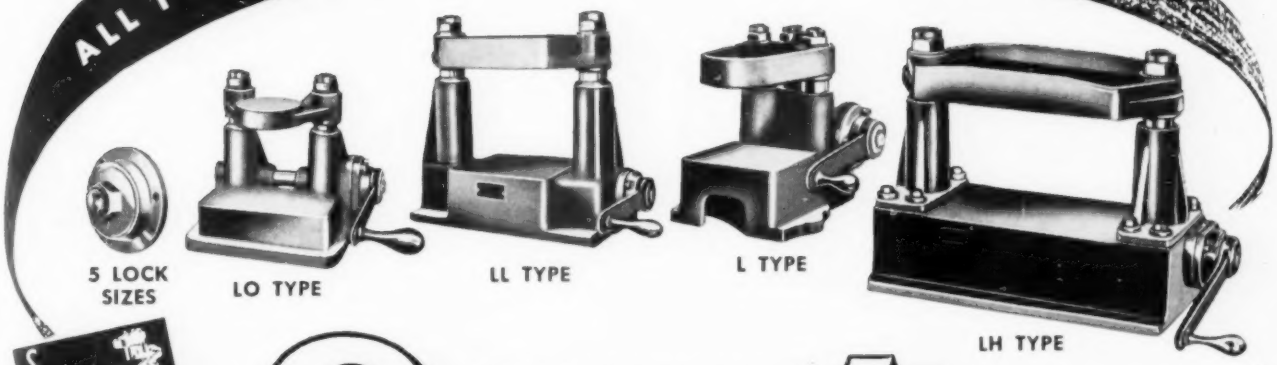
| TYPICAL PRODUCTS | TYPICAL CYLINDERS | TYPICAL USES |
|---|---|---|
| LIFT TRUCKS |  4½" bore x 64" stroke  4" bore x 7½" stroke | On lift trucks, hydraulic cylinders hoist and tilt the load, actuate special grabs and other attachments. |
| BULLDOZERS | 5" bore x 24" stroke | On bulldozers and other blade-type equipment, hydraulic cylinders are used to lift, lower and position the blade. |
| MINING DRILLS  | 3½" bore x 10" stroke | On mining drills, hydraulic cylinders position the drill arms, level the unit, hold the machine steady while drilling. |
| LATHES |  6½" bore x 10" stroke | On lathes, pneumatic or hydraulic cylinders advance tail stock on automatics, bring entire head assembly into position on turrets. |
| POWER SHOVELS AND LOADERS  | 7" bore x 47¾" stroke | On power shovels and loaders, hydraulic cylinders perform such important functions as digging, leveling, lifting, steering and turning. |
| FARM MACHINERY | 2½" bore x 14" stroke | On farm machinery, hydraulic cylinders actuate swing, grab, lift and steering mechanisms, position plow and harrow blades. |
| VALVES  |  8" bore x 10¾" stroke | On large valves, pneumatic or hydraulic cylinders provide automatic operation, are much used where electric operation might be hazardous. |

# Got a deadline to meet?

*If you had a* ***Swartz Standard Fixture***
*in <u>your</u> shop your tooling problem*
*would be solved.*

***Swartz Fixtures*** *are usable on a multitude of jobs.*

**ALL TYPES OF SHOP PRODUCTION TOOLS**



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MAKE USE OF OUR ENGINEERING SERVICE. AN AGENT WILL BE GLAD TO CALL.

*There's a Swartz man near you*

# Swartz

## TOOL PRODUCTS

DIVISION OF JEFFERSON CORPORATION

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HIGH SPEED
HYDRAULIC

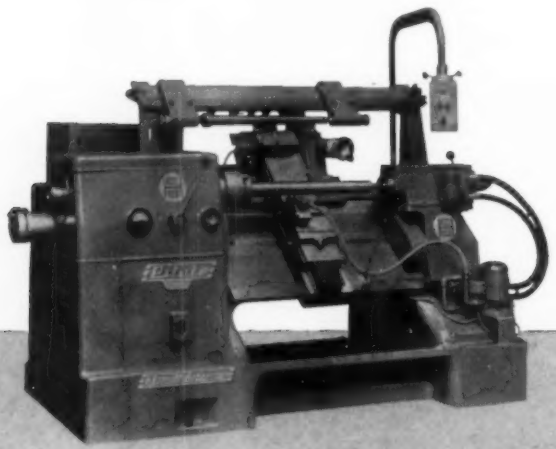
# Copying Lathes

*for every purpose!*

THE TURNING METHOD OF THE FUTURE TODAY!

The greatest advance in turning methods since the development of carbide tools! Whether your production is on a large scale or you need short, economical runs, there is an H.E.B. Copying Lathe to fit the special needs of your operation.

Why use a dozen tools when the H.E.B. *with just a few* does the job faster, better and at less cost! Incorporating the patented H.E.B. tracer device these versatile machines give you maximum output at high speed with remarkable accuracy and finish.

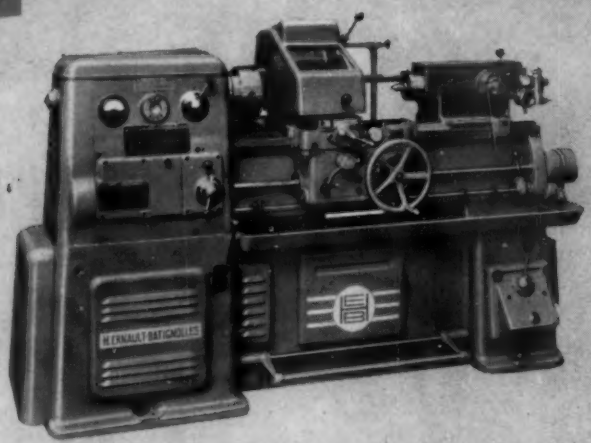


**H.E.B. PILOTE COMPLETELY AUTOMATIC HYDRAULIC COPYING LATHE**

The first *completely automatic* hydraulic copying lathe. The operator has only to load the machine and *press a button* to start the cycle. When the part is finished the tool returns to its starting position and the spindle stops automatically! Savings in setup time and tooling costs are enormous. Motors to 60 H.P.

COMPLETELY AUTOMATIC

SEMI-AUTOMATIC



**H.E.B. HIGH SPEED HYDRAULIC COPYING LATHE**

This absolutely rigid, chatter-free machine with built-in tracer device eliminates costly down time, takes no more than 10 to 20 minutes for setting up and the finished parts are copy turned up to 300% faster than on multi-tool lathes.

The OP Model, with its 20 H.P. motor, takes heavy cuts with carbide tools at spindle speeds 50 to 3600 RPM. GT Models with rotating pattern are designed to copy an infinite variety of non-circular work.

**These machines are designed and built in France by H. Ernault Batignolles, machine tool manufacturers for almost a hundred years. If you want more information about tomorrow's turning methods, then write, wire or telephone now for a demonstration or catalog. See our insert in Sweet's Machine Tool Catalog.**

"THE WAY TO TURN"

H·E·B

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COPYING LATHES · ENGINE LATHES WITH COPYING ATTACHMENTS · CARBIDE TOOL GRINDERS · RADIAL DRILLS

# Tool Steel Topics

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Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

Finishing touches are applied to a die made of Cr-Mo-W (Chrome-Moly-Tungsten) at extrusion plant of Kaiser Aluminum & Chemical Corp.

Lathe operator calipers die blank, made of Cr-Mo-W. This long-wearing, air-hardening steel, easy to machine, has good shock resistance.

• • • • • • •

## BETHLEHEM TOOL STEEL ENGINEER SAYS:

### *To Reduce Tool Failures Always Remove the "Feather" Edge*

After tools are ground, a rough "feather" may often be found along the working edges. If this feather is permitted to remain, the chances are good that the cutting edges will dull prematurely. Or the tool may even fail after brief service. For best results it is advisable to remove these surface irregularities immediately after grinding. This is especially true of cutting tools.

We know several shop men, each of whom makes it a point to carry a pocket stone, just for this use. When a feather is noticed, out comes the stone. This worthwhile precaution results in longer tool life, and greater shop economy.

# Why they chose this Hot-Work Steel for Aluminum Extrusions

They wanted a hot-work steel with great resistance to wear, capable of withstanding severe shock and drastic changes in temperature, and with the ability to provide trouble-free service in long production runs. And it's for those reasons that the die specialists at the busy extrusion plant of Kaiser Aluminum & Chemical Corp., located at Halethorpe, Md., are well pleased with the performance of Cr-Mo-W (Chrome-Moly-Tungsten) for the manufacture of aluminum extrusions.

Bethlehem Cr-Mo-W, a general-purpose type of hot-work tool steel, has a 5 pct chromium content, plus moly and tungsten. It is especially suited for jobs that involve shock or radical temperature changes, and for all applications where heat-checking is a problem.

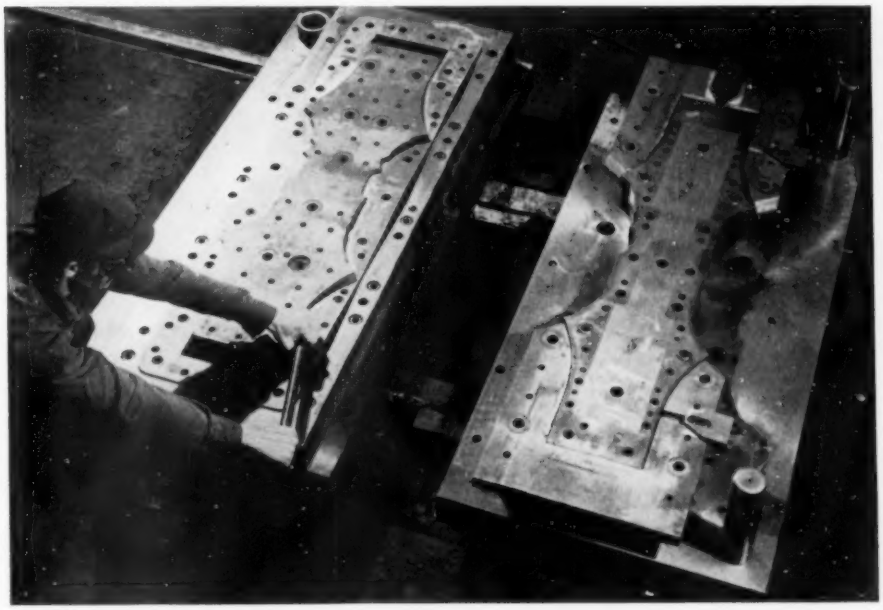
Cr-Mo-W hardens in air. It has good red-hardness, and fine resistance to distortion during heat-treatment. It is an easy steel to machine because it can be annealed to 217 Brinell.

TYPICAL ANALYSIS

| | | | |
|---|---|---|---|
| Carbon | 0.35 | Tungsten | 1.55 |
| Silicon | 1.05 | Molybdenum | 1.65 |
| Chromium | 5.00 | | |

Cr-Mo-W withstands severe impact on such highly-stressed parts as trimmer dies, die-casting dies, bolt-gripper dies, hot-shear blades, and various types of punches.

If you have a job calling for a hot-work steel able to take shock and wide changes in temperature, and hold its dimensions through long production runs, give Cr-Mo-W a tryout. You can get full information, and quick delivery, from the nearest Bethlehem tool-steel distributor.

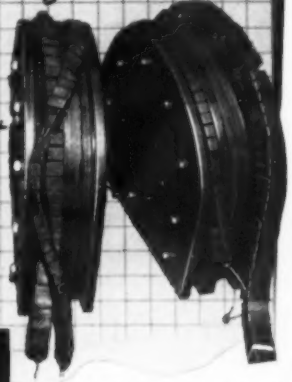


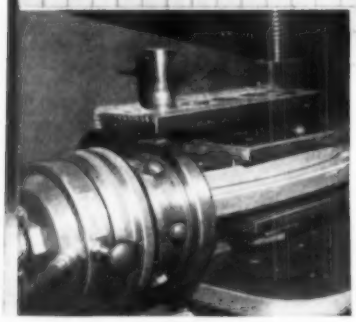
## DIE TO BLANK DIFFERENTIAL HOUSINGS

This large die, made of A-H5, is used in the cold blanking of sheet steel for the manufacture of truck and automobile differential housings. A-H5, another Bethlehem 5 pct chrome air-hardening grade, with 1.00 pct carbon, is used for this application because of its wear-resistance, and easy machinability.

If you are forming light metal parts

Hi Den has important advantages for you





Above: Flexible "snake" of Hi-Den used on Hi-Den stretch die to support preformed walls of channal sections during stretch forming.

Left: Hi-Den die forming hat section on Hufford Stretch-Wrap Forming Machine. Section is 8" wide x 60" long, .040 thick 24 SO aluminum alloy. 75 ST alloy parts are formed on the same die.

Far stronger than equal weight in steel, lighter in weight, easier to fabricate and to handle. HI-DEN, a laminate of wood veneers impregnated with phenolic resin and compressed under extreme heat and pressure, is being used in some of America's largest light metal plants to **save up to 66% of tool-fabrication costs.**

Because it is easily shaped with standard tungsten carbide tools, has a low coefficient of friction, dimensional stability and is resistant to oil and moisture, users in the aircraft and other light metal industries have reported **more than 100 different applications** for HI-DEN.

**Truly amazing savings have been achieved** with HI-DEN forming, stretch, draw and press-brake dies, Yoder rolls, jigs, fixtures, templates, and pressure pads.

Why not send today for our Technical Bulletin and literature showing how to get increased production of improved quality products at lower cost with HI-DEN.

P.S. HI-DEN is ideally suited for use in Hydro-form and Mar-form presses.

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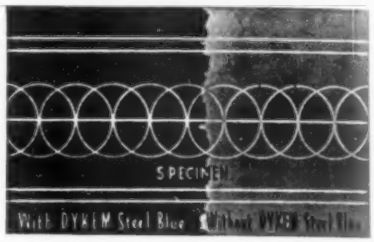


Simply brush on right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed layout show up in sharp relief and at the same time prevents metal glare. Increases efficiency and accuracy.

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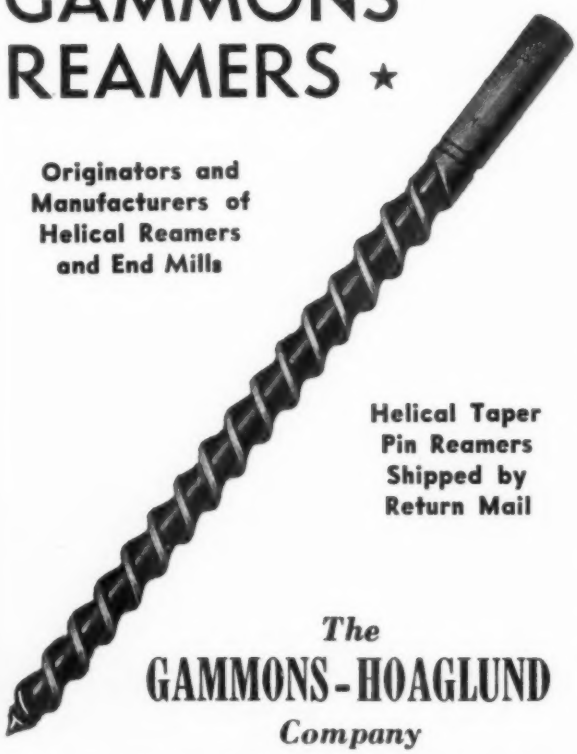
Originators and Manufacturers of Helical Reamers and End Mills



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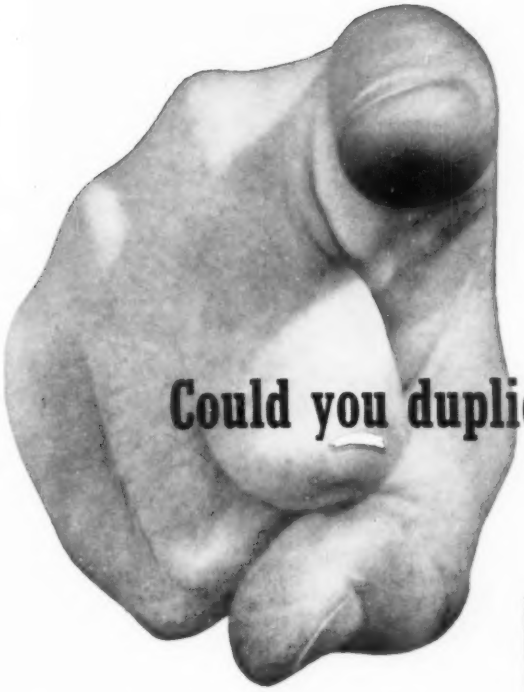
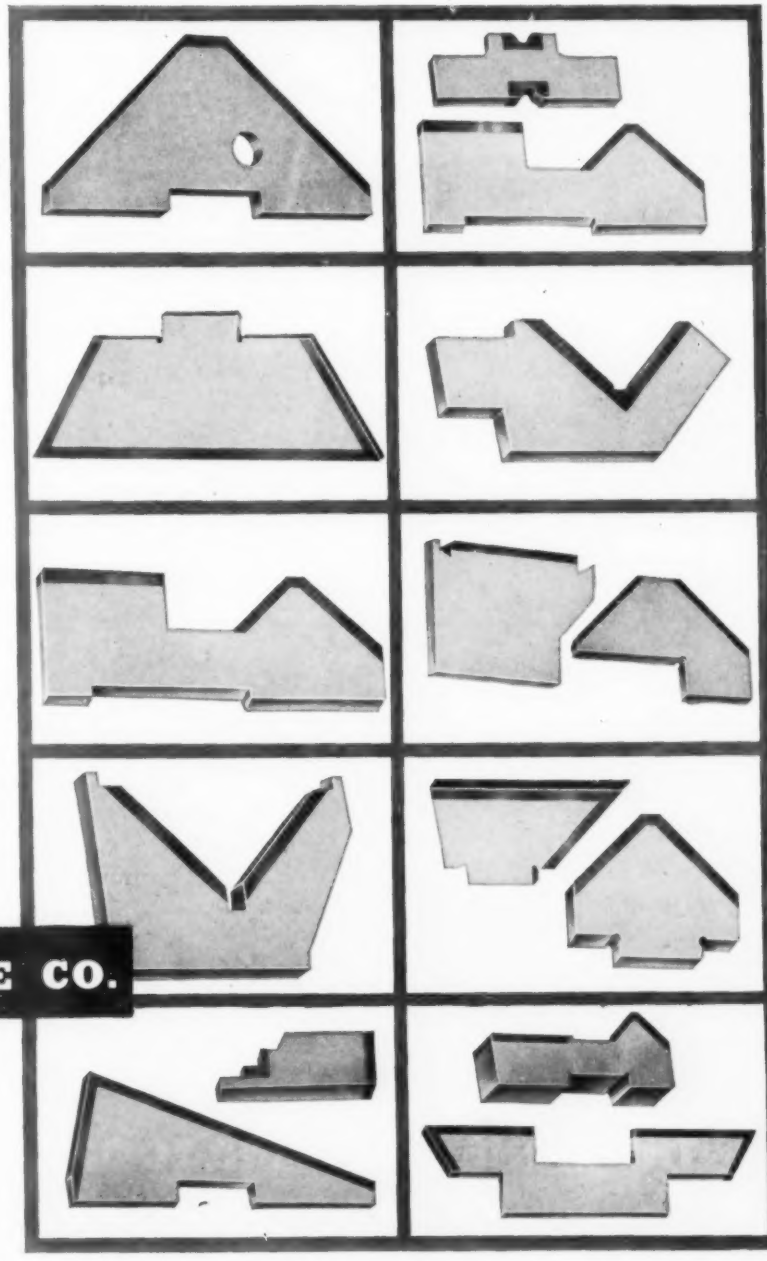


# Could you duplicate these OK hardened ways?



**Here are only a few of the wide variety of shapes made possible by OK 3-point advantage:**

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**2. SPECIAL HEAT-TREATMENT** OK ways' extreme hardness (65-66 Rockwell "C") to a uniform depth is a key factor in successful performance regardless of shape.

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"EXPERIENCE WITH THE SIDNEY 20" TRACING LATHE IN DEPARTMENT B6-406 OF THE DOUGLAS EL SEGUNDO, CALIFORNIA DIVISION INDICATES A CONSIDERABLY IMPROVED PRODUCTION CAPACITY. THE TRACING LATHE WE ARE OPERATING ELIMINATES HUMAN ERROR AS FAR AS LINEAL DIMENSIONS ARE CONCERNED."

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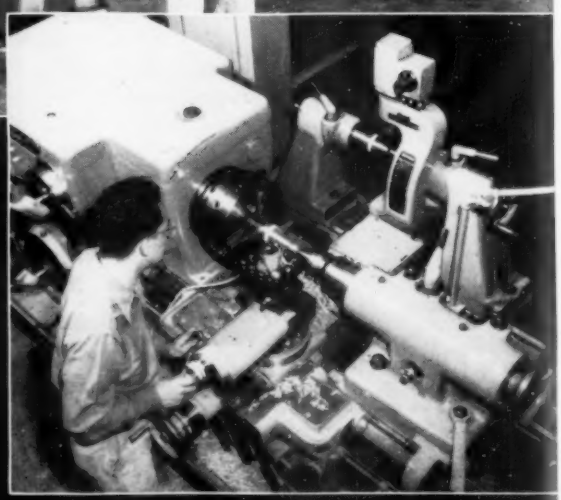
*Photographs show Sidney Tracer Lathe making a tapered cut on airplane arresting hook tube.*



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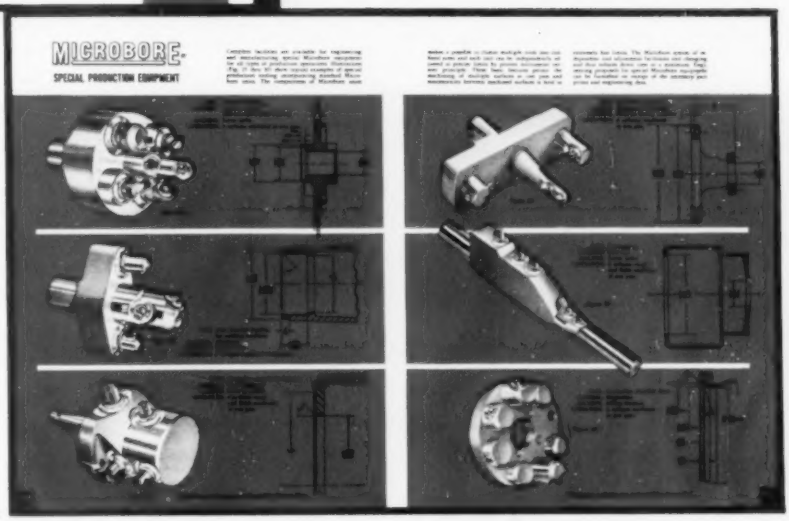


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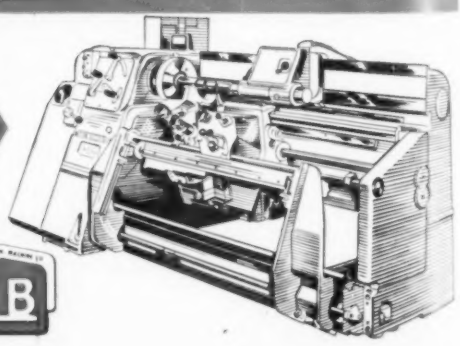

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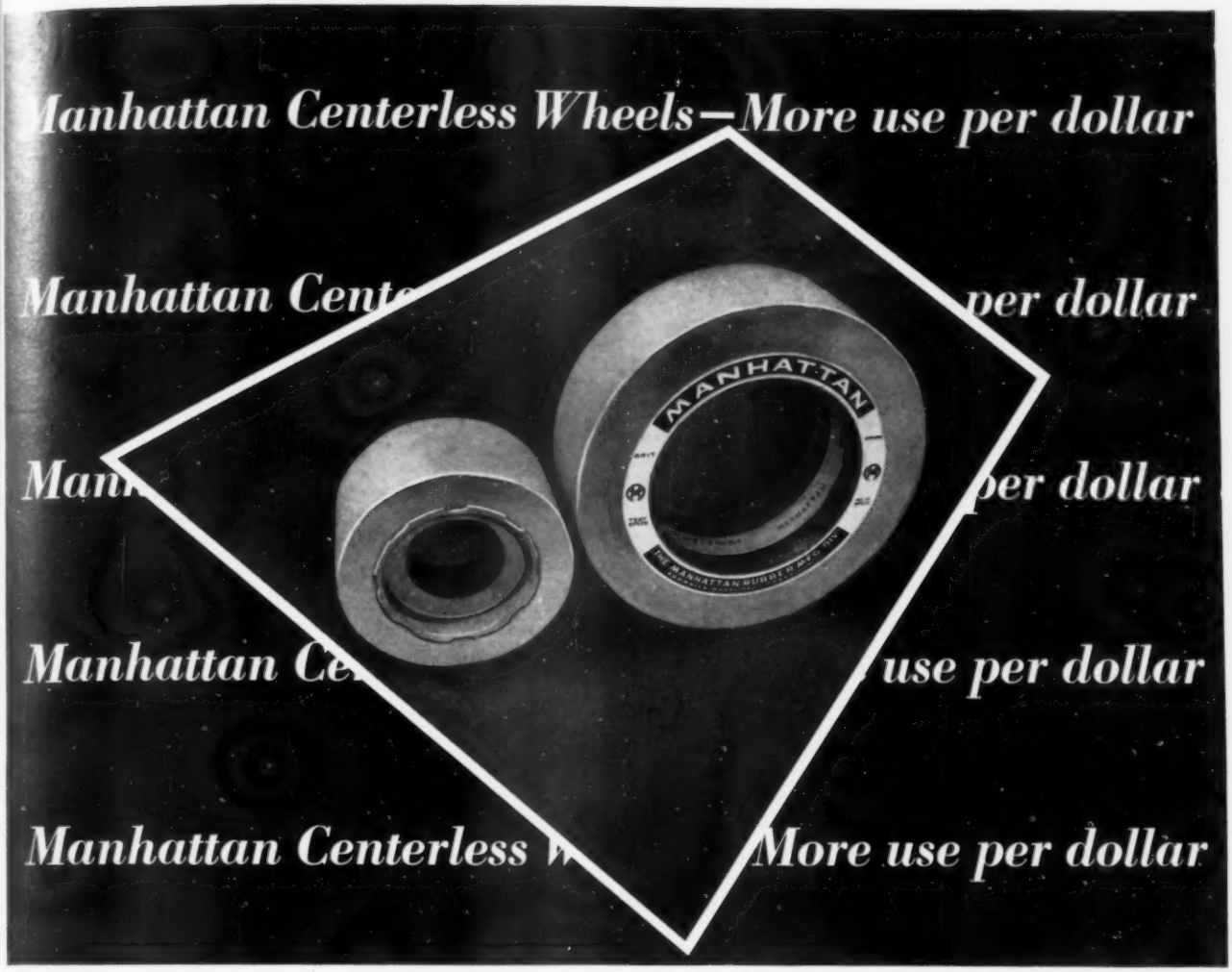
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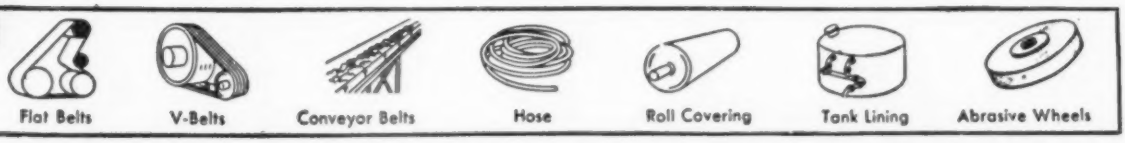


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## *Leonard J. A. Smit Memorial Award*

*for new uses of industrial diamonds*

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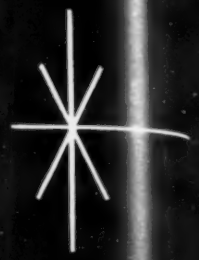
ENGINEERED DIAMOND TOOLS SERVING INDUSTRIAL AMERICA

# Leonard J. A. Smit



## Purpose of Award.....

The late Leonard J. A. Smit, co-founder of ANTON Smit & Co., Inc., believed profoundly that the discovery of new or improved uses of industrial diamond tools must be encouraged by rewarding individual thinking on industrial tool engineering and tool application problems. The Leonard J. A. Smit Award has been established by the Directors of ANTON Smit & Co., Inc. not only as a memorial, but as a concrete contribution to the advancement of American industrial method.

## Presentation of Awards.....

First prize consists of a $1000 U. S. Savings Bond; second prize, $600 in U. S. Savings Bonds; and third prize, $400 in U. S. Savings Bonds. One hundred copies of a valuable textbook, *Diamond Tools* by Paul Grodzinski, will be awarded as "honorable mention" prizes. A formal presentation will be made to the three top winners at the Leonard J. A. Smit Memorial Dinner, which is to be held concurrently with the national convention of the American Society of Tool Engineers in April 1955. Leonard J. A. Smit Memorial Award medals will be struck for the occasion.

## Who is Eligible.....

The Leonard J. A. Smit Award is not restricted to tool engineers or to specialists in tooling. Competition is open to anyone, except employees of ANTON Smit & Co., Inc. and their advertising agency.

## Judging.....

All entries are subject to primary screening by the Applications Engineering Division of ANTON Smit & Co., Inc. Each will be judged solely on the basis of its value as a suggestion or design for a new or improved use of diamonds in industry. Final judging is to be conducted by a panel of eminent technical experts selected from representative industrial fields. Decision of the judges is to be considered final. In the case of a tie, duplicate prizes will be awarded.

# Memorial Award

## How to prepare your entry

By filling out and mailing the attached application, or by otherwise supplying the information requested on it, you will receive by return mail an Official Award Entry Kit, consisting of an entry form with graph-ruled sketching sheets; ***Diamonds At Work,*** a valuable little volume designed to provide you with general background information; an Official Tool Data Blue Book filled with actual tool specifications; a number of Technical Data Query Cards which enable you to request conveniently any special information from the Applications Engineering Division of ANTON Smit & Co., Inc. which you may need to complete your entry design; and a self-mailer envelope in which to submit your entry. You may submit as many separate entries as you wish. If you desire to submit actual models or supplementary material, please make certain that they are properly insured with the postal authorities since ANTON Smit & Co., Inc. cannot assume responsibility for them. Written entries will not be returned, and models will be returned only if sufficient postage is enclosed

## ENTRY BLANK • *Leonard J. A. Smit Memorial Award*

### *Rules*

**Full Rights Assured . . .**
**All entry ideas remain the property of entrants.** It is understood by entrant, however, that ANTON Smit & Co., Inc. is to be given first option on the purchase of rights to any of the winning entries.

**Closing Date . . .**
Entries postmarked later than December 1, 1954 cannot be considered by the judges. All such entries will be automatically disqualified from competition.

**Competition Rules . . .**
It is to be understood by every entrant that by entering the Leonard J. A. Smit Award competition he thus signifies his intention to abide by the regulations and conditions as stated above.

Name

Home Address State

Firm Name

Firm Address State

Title

***Address all correspondence to:***

Leonard J. A. Smit Award Panel
c/o ANTON Smit & Co., Inc.
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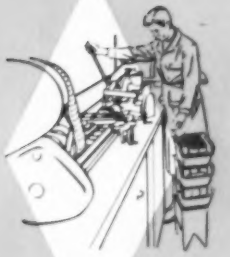

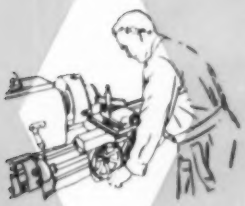

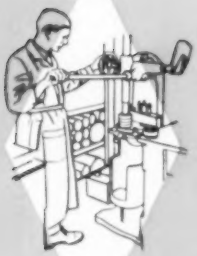

# *Diamonds at work...*

The late Leonard J. A. Smit, co-founder of ANTON Smit & Co., Inc., New York, was probably the best known modern authority on industrial diamonds.

A resident of the United States for many years, and shortly to have become an American citizen—as is his wife who is now president of ANTON Smit & Co., Inc.—Leonard Smit was born in Amsterdam, where his father, who is usually credited with having been the first to recognize the use for diamonds in industry, first applied diamonds, rejected for cutting gem stones, to the truing of flour mill grindstone wheels. The Smits are truly, then, pioneers in this now greatly expanded field.

During his lifetime, Leonard Smit many times made the point that the precision mass production which has done so much to raise America to world leadership in industry would have been absolutely impossible without industrial diamonds. Certainly, then, the world is much the richer for having . . . ***diamonds at work.***

Leonard Smit had long felt it desirable to contribute the means for stimulating constructive interest in new and extended uses for industrial diamonds. It was his conviction that by encouraging advancement in his chosen field he could thus further the peace by strengthening the industry of the country he loved so well.

Through the means of the Leonard J. A. Smit Award, ANTON Smit & Co., Inc. makes its contribution to the continuance of the high purposes to which Leonard Smit dedicated his life.

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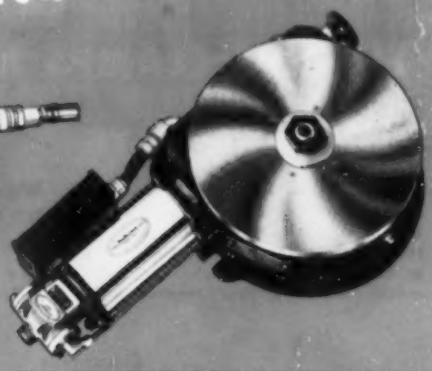

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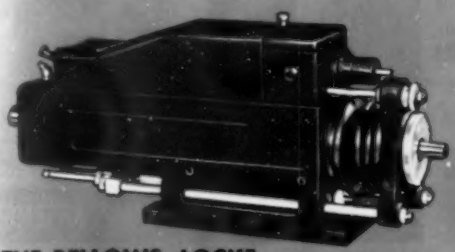

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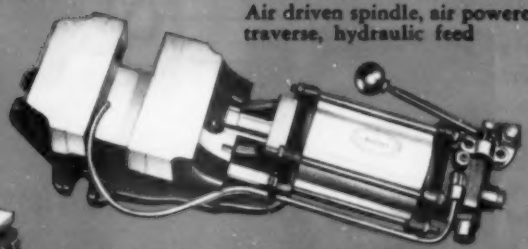
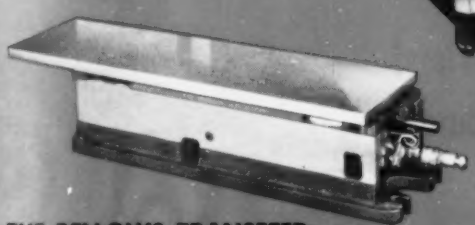
**THE BELLOWS HYDRAIR DRILL UNIT**
Air driven spindle, air powered traverse, hydraulic feed

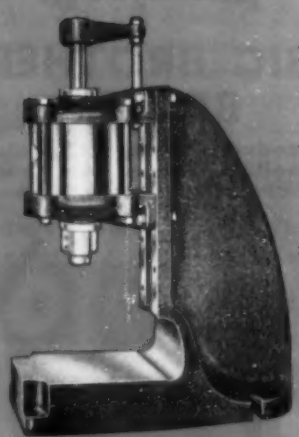


**THE BELLOWS CV-40B AIR VISE**
A ready made jig for handling small parts

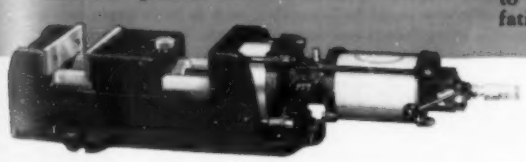


**THE BELLOWS TRANSFEED**
a two position work feeder — operator loads and unloads while work is going on

**THE BELLOWS INFEED ATTACHMENT**
to speed production, lessen operator fatigue, reduce rejects in centerless grinding



**THE BELLOWS ARBOR PRESS**
For fast, safe, light pressing or stamping



**THE BELLOWS DVH-150 VISE**
Air-Hydraulic Vise for milling machine operations

# The Bellows Co.
AKRON 9, OHIO

B14-A

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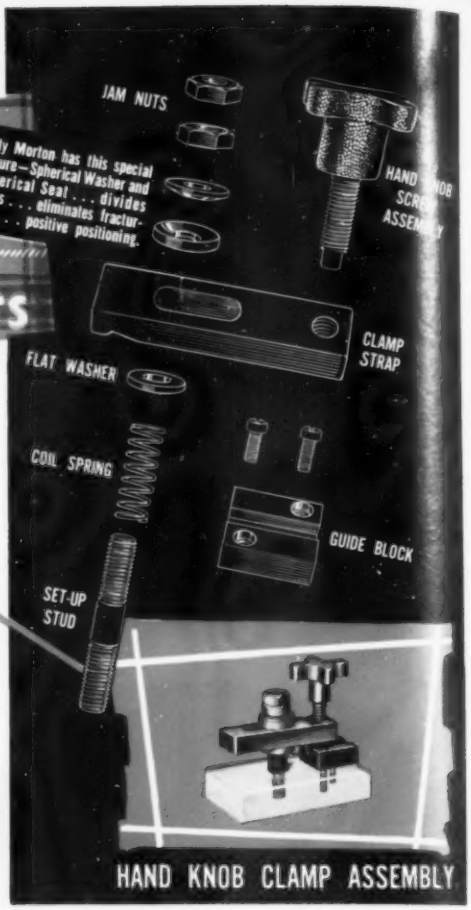
JAM NUTS
Only Morton has this special feature—Spherical Washer and Spherical Seat . . . divides stress . . . eliminates fracturing . . . positive positioning.
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Just select the Clamp or Component that fits your need . . . trace into your design. Full size templates of each product, bound in loose leaf style for easy removal, available upon request.

We stand behind every product we manufacture.

We assure IMMEDIATE delivery.

Economize . . . use them as STANDARDS. All precision made of heat treated selected steel, cadmium plated and corrosion resistant mid-nite black finish. Individual parts on assemblies may be purchased separately. MORTON assures you of QUALITY and SERVICE.

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# Multiform BIG BROTHER BENDER

**Produces Without Special Tooling—Saves Die Costs Saves on Expensive Presses**

Model BBB

Illustrated above are a few of the many forms that can be produced efficiently on the Multiform Bender, using the standard tooling.

The heavy duty Big Brother Bender is designed for fabricating bus bars, brackets, fixtures, etc., without special tooling. Air controlled with finger tip response. Comes complete with dies, mandrels and wrenches—punching and blanking dies extra. Will punch holes up to 1" and form material up to ¼" thick by 4" wide. We also build smaller hand or air operated models for forming up to ⅛"x1½" material.

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**J. A. RICHARDS CO.** 903 North Pitcher St. Kalamazoo, Michigan

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# Hardness testing made *Easy!*

**Save Time!**
**Test Accurately!**

*Ames* PORTABLE
## HARDNESS TESTERS

Frequent hardness testing of metals before and during fabrication and after heat treating is essential today for best results.

Ames Portable Hardness Testers answer the need for a light weight, accurate, dependable tester that may be carried to the work for on-the-job testing. They are easy to use, require no skill, and get speedy, accurate tests wherever the work may be—no delays, no cutting off specimens—no waiting for laboratory tests.

Besides testing flats, rounds, tubing, etc. Ames Hardness Testers make tests that otherwise would be impossible, such as large gears, knives, saws, blades, struts, frames and assembled parts. Thousands are in use paying for themselves over and over again in time and materials saved.

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**AMES PRECISION MACHINE WORKS**
*Makers of Ames Precision Lathes and Bench Millers*
Waltham 54, Massachusetts

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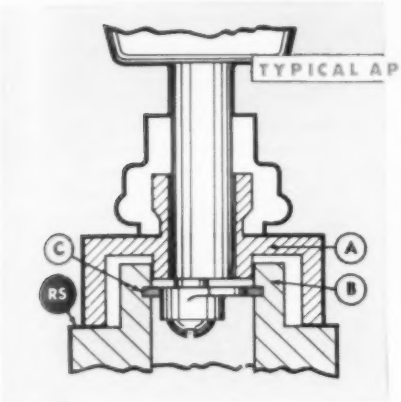
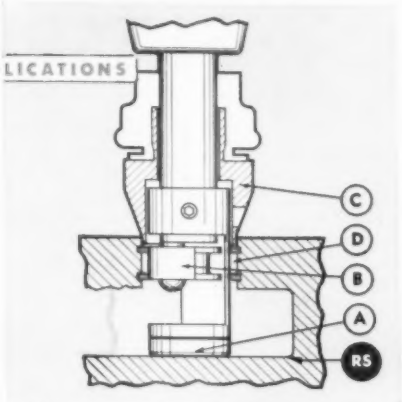
# Waldes Truarc Grooving Tool Out-Performs Conventional Recessing Tools

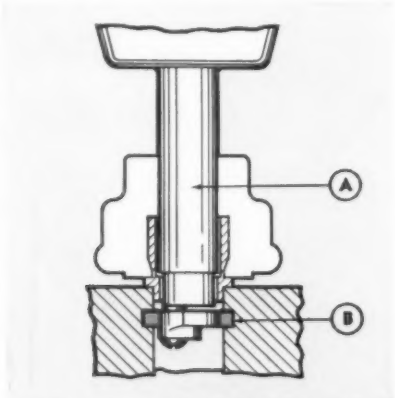
## SAVES TIME! CUTS COSTS! NEEDS NO SKILLED LABOR!



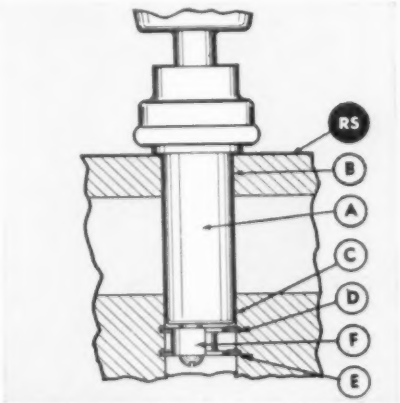

**Clearing Obstructions or Protrusions** — Waldes Truarc Grooving Tool with *special bushing* with high shoulder A in order to clear obstruction B on reference surface RS so groove can be properly located in bore.



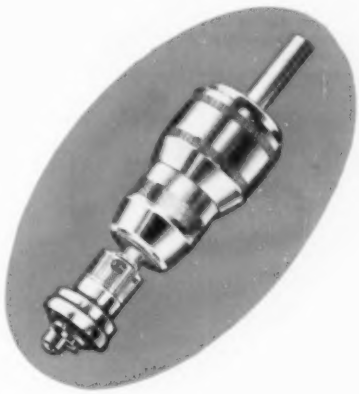

**Locating Grooves from Bottom of Hole or Blind Hole**—Use of *bottom adaptor* A and double cutter B. Bushing C pilots tool into bore D while bottom adaptor acts as stop to locate grooves from reference surfaces RS below bore.




**Small Diameter Bore — Need for Wide Groove** — Great versatility of tools allows A-2 Tool to accept *stepped down spindle* and *cutter-shaft* assembly A. Provides cutting capacity in a bore normally within the range of smaller A-1 Tool. Illustrated, larger tool capacity necessary to cut groove diameter B exceeding normal capacity of standard A-1 Tool.




**Extending Reach of Tool** — Waldes Truarc Grooving Tool assembled with *extended bushing* A increases normal range of tool in order to reach proper groove location in bore. Bushing also registers on reference surface RS of workpiece while piloting tool at two points B and C inside bore. Two grooves D and E are cut simultaneously with double cutter F.



**AMAZINGLY VERSATILE!** The Waldes Truarc Grooving Tool adapts quickly and simply to your toughest recessing requirements. With it, even *unskilled labor* can perform and maintain high precision, mass production operations.

**WIDE CUTTING RANGE!** The Waldes Truarc Grooving Tool comes in five models: A-1, A-2, A-3, B and C. This wide variety of models enables you to cut accurate grooves in housings with diameters from .250 to 5.000 inches. Special features, modifications and adaptations allow each model to operate efficiently under many varying conditions.

**SEND YOUR PROBLEM TO WALDES!** Whatever your internal grooving problem, send us your blueprints and let Waldes Truarc engineers give you a complete analysis, price quotation and delivery information on the most economical tool set-up for your particular job.

WRITE NOW FOR 20 PAGE TECHNICAL MANUAL CONTAINING FULL ENGINEERING DATA

**WALDES TRUARC** *Reg. U. S. Pat. Off.* **GROOVING TOOL**

MADE BY THE MANUFACTURERS OF WALDES TRUARC RETAINING RINGS.

WALDES KOHINOOR, INC., 47-16 Austel Pl., L.I.C.1, N.Y. Waldes Truarc Grooving Tool mfd. under U.S. Pat. 2,411,426

TE016

**Waldes Kohinoor, Inc., 47-16 Austel Place**
Long Island City 1, New York

Please send me your new 20-page technical manual on the Waldes Truarc Grooving Tool.

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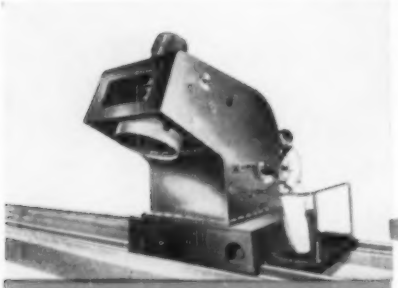
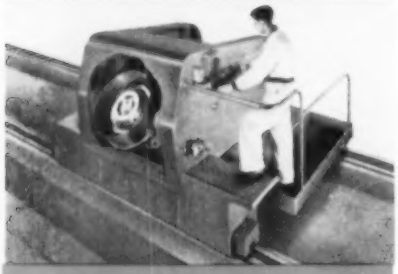
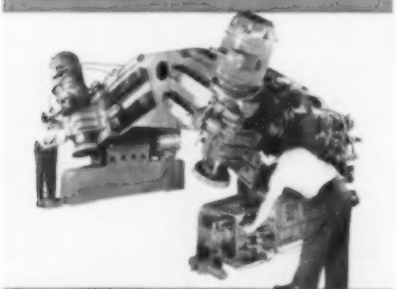


Precision roller bearings carry grinders smoothly over protected steel ways.



Wheels and spindle units can be changed as conditions demand.

System of electrical interlocks governs pre-determined automatic movement.



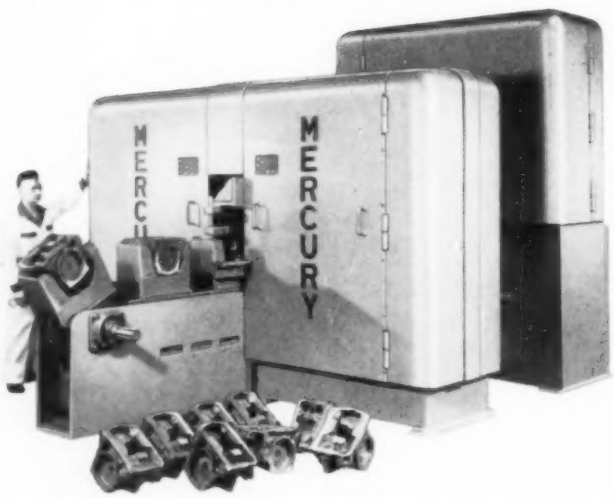
Spindle downfeed is obtained by smooth, positive hydraulic action.

Travel distance is limited only by job conditions and shop restrictions.

# MERCURY *Grinders* LEAD THE FIELD

The proven development of traveling wheel grinders has given Mercury top position in the field. These machines are available in sizes up to 150 horsepower and with wheels as large as 42 inches in diameter. Mercury Grinders travel on smooth steel ways which are laid down in sections of one-piece construction. Grinding length is unlimited with this unique, cost-cutting design.

## AUTOMOTIVE GRINDERS

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**ENGINE BLOCKS**
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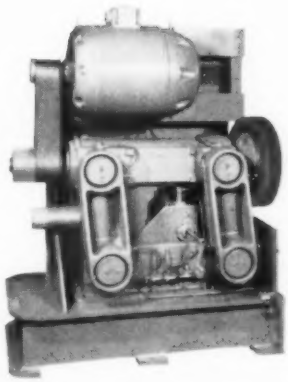
**CRANK CASES**

### 750 Automotive Castings Per Hour Ground on Three Sides

Many shops are setting production records in the preparation of castings for the automotive industry. Costly and inefficient manual handling is reduced to a minimum, and consistently superior finish is assured. Completely sealed for safety and protection, Mercury Automotive Grinders have simplified operation and maintenance. Available from 20 thru 100 horsepower.



Unique Toggle-Arm* action guides the wheel on the work surface. Remote control of positive hydraulic downfeed in specified increments simplifies operation.

SINCE 1933 A SYMBOL OF FINE CRAFTSMANSHIP

*Write for Bulletin No. F-739*

**MERCURY ENGINEERING CORPORATION**

2100 N. FARWELL AVE. MILWAUKEE 2, WISCONSIN

*or Precision*

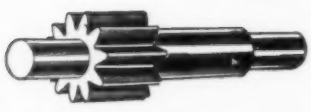
*+ Low Cost:*

# MIKRON

## GEAR HOBBER #79

**Mikron Hobbing Machines Excel Where High Precision Machining Standards Must Be Maintained**

• **MIKRON No. 79** is an excellent choice for small spur gears and pinions. It is simple to operate, to set-up and to change-over from job to job. CAPACITY: Gears, max. dia. $1\frac{9}{16}''$; max. length of cut $1\frac{1}{8}''$; number of teeth 6 to 390; pitch DP 26 and finer.



**RUSSELL, HOLBROOK & HENDERSON, INC.**

**292 Madison Avenue, New York 17, N. Y.**

## MACHINE STAMPING AND EMBOSSING DIES

Higher production with CADILLAC Dies is assured by special steel selection, controlled heat treatment and precision engraving — noted for accuracy and high quality. We'll be glad to advise you on best marking methods.

PUNCH PRESS DIE

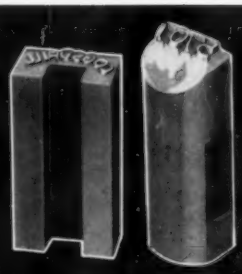
ROLL SEGMENT DIE

SOLID ROLL DIE

## HEAVY BEVEL STEEL LETTERS AND FIGURES

The faces of CADILLAC Steel Letters and Figures combine a high degree of hardness with toughness, insuring exceptionally long life. Each stamp is clearly marked with character designation and size. Long tapering bevels assure easy alignment of characters. *(To the right, note CADILLAC's sturdily boxed Interchangeable Steel Type Set.)*

FORGING HAND STAMP



DIE INSERTS

EMBOSSING DIE

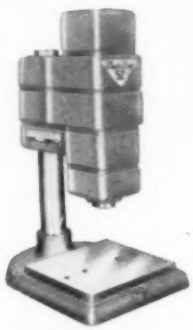
# You Don't Need An X To Mark "The Spot"

## There Are CADILLAC MARKING DEVICES Designed For ALL Marking Needs

Just as "variety" is called "the spice of life", varieties of marking methods and devices are essential for meeting modern production demands. CADILLAC STAMP COMPANY is equipped to offer or build every conceivable type of marking device, from simple hand stamps to especially created and designed machinery for unusual marking requirements.

### CADILLAC 115 HAND MARKING MACHINE

For general purposes this floor type machine gives top service. Marking is done in a rolling operation—requiring minimum pressure. Marks flat or round parts of varying thickness. Foot pedal for marking flat or irregular contoured parts; table screw adjustable for round parts.



### CADILLAC 52 AIR IMPACT PRESS

For high speed marking, assembling, branding, staking, crimping, riveting, also for producing light stampings. The 52 effects great savings in production — delivers speeds up to 10,000 strokes per hour—pressure up to 8 tons. Safe to operate, automatic controls. Can be hand, foot or electrically actuated.

**Machines Above, Write for Bulletin M-120**
**Misc. Items, Write for Bulletin SE-130.**

### CADILLAC 45 HYDRAULIC MARKING MACHINE

Here's a compact, self-contained, manifold mounted, hydraulic unit. One control gives full range of marking depth. It will mark round, flat and irregular surfaces. Machine capacity is up to 110 one inch impressions per minute.

HAND STAMP NUMERALS

INTERCHANGEABLE TYPE AND TYPE HOLDER SET

HAND STAMP SYMBOLS

CADILLAC Marking Devices

# CADILLAC STAMP COMPANY

Factory and Offices

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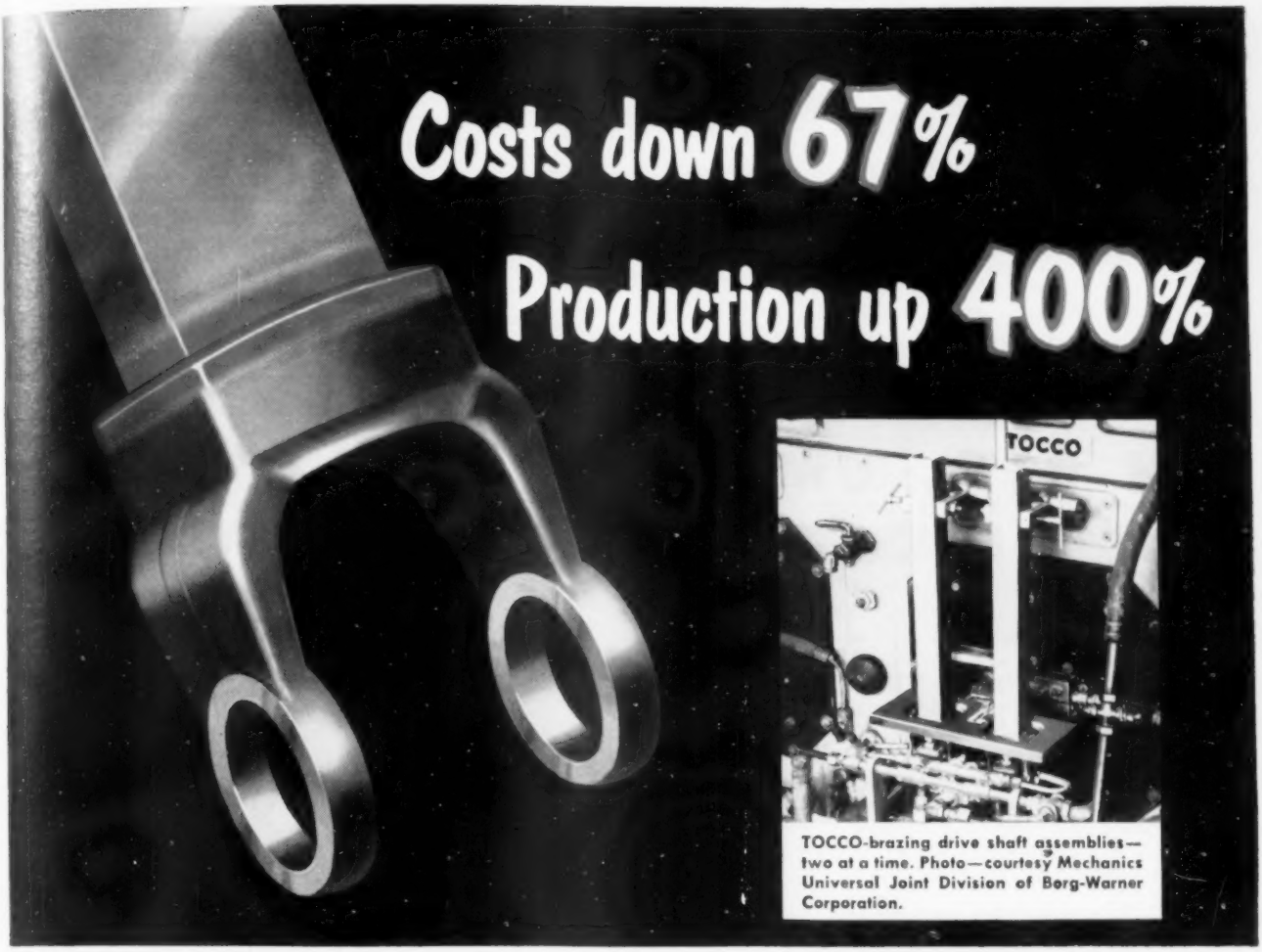


TOCCO-brazing drive shaft assemblies—two at a time. Photo—courtesy Mechanics Universal Joint Division of Borg-Warner Corporation.

# with TOCCO* Induction Brazing

The shift from welding to TOCCO* induction brazing of the drive shaft assembly pictured here is typical of savings accomplished by TOCCO in over a thousand of America's leading metal-working plants. If you have brazing, soldering, heat-treating or heating for forming or forging operations in your plant TOCCO can probably save you money too.

**COSTS DOWN 67%**—Mechanics Universal Joint Division of Borg-Warner reports a 67% cost reduction in TOCCO-brazing yokes to tubing in the manufacture of power transmission shafts. Formerly, parts were hand-welded.

**PRODUCTION UP 400%**—Automatic TOCCO increases production from 11 to 45 pieces per hour—400% faster than former method. In addition TOCCO-brazing produces a cleaner, neater joint than possible with previous method.

**TOCCO** Engineers are glad to survey your plant, without obligation, of course, to determine where TOCCO Induction Heating can speed your production and cut your manufacturing costs.

**THE OHIO CRANKSHAFT COMPANY**

TOCCO

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Please send copy of "Typical Results of TOCCO Induction Hardening.

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City_____ Zone____ State_____

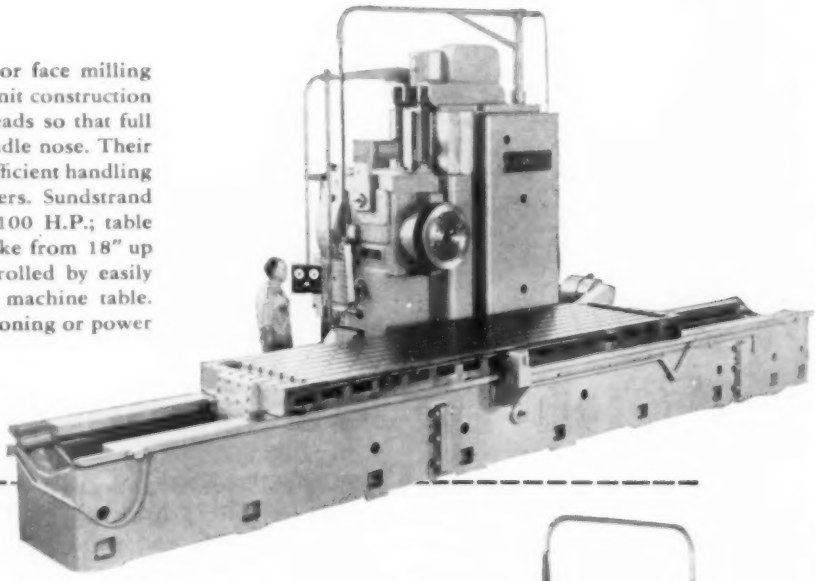
# You'll Get Better Methods, Lower Costs from SUNDSTRAND "Engineered Production" and Equipment...

These standard basic Sundstrand Rigidmils can, and have been, tooled in various ways to lower production milling costs. Countless plants using these machines with Sundstrand "Engineered Production" methods and accessories have found these machines most productive and economical. Call in a Sundstrand engineer to assist you with your milling problems. There is no obligation for this service.

# ON BIG, SMALL, SIMPLE OR COMPLICATED MILLING JOBS

## SIMPLEX RIGIDMILS

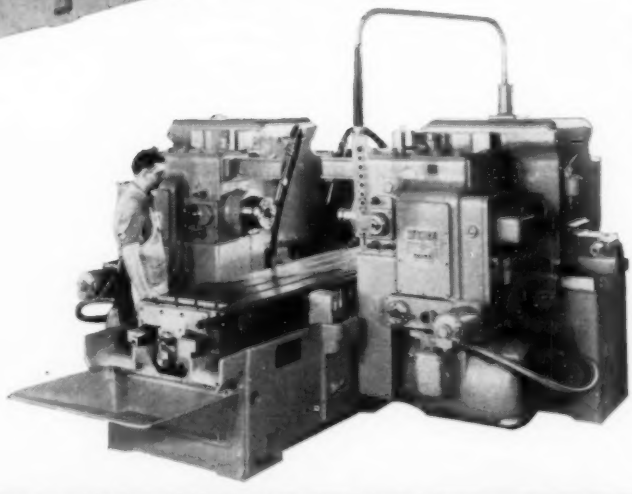
Sundstrand Simplex Rigidmils perform slab or face milling operations with one spindle. They are of the unit construction type and have independently motor driven heads so that full horsepower rating of head is delivered at spindle nose. Their extremely wide speed and feed range permits efficient handling of many different materials and sizes of cutters. Sundstrand Simplex Rigidmils range in size from 3 to 100 H.P.; table size from 10½" up to 48" wide and feed stroke from 18" up to 216". Table cycles are automatically controlled by easily adjusted dogs mounted on the front of the machine table. All models can be furnished with power positioning or power feed to the head as extra equipment.



## DUPLEX RIGIDMILS

Parts with opposed faces can be machined much more accurately and economically on Duplex Type Rigidmils. These machines, having the same basic features as the Simplex, are made with fixed columns or with adjustable columns.

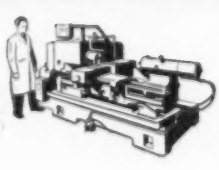
The fixed column type machine has endwise adjustment of the spindle quills only. The adjustable column type provides maximum cutting rigidity over a much wider range for milling both wide and narrow work pieces. The Model O size has manual adjustment for column positioning, while Models 33 and 55 have power movement. Other sizes available on request.

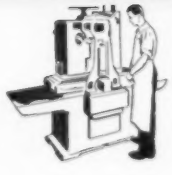


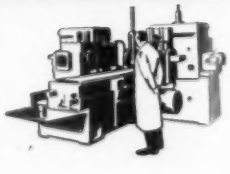
SUNDSTRAND "Engineered Production" Service*

*REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS

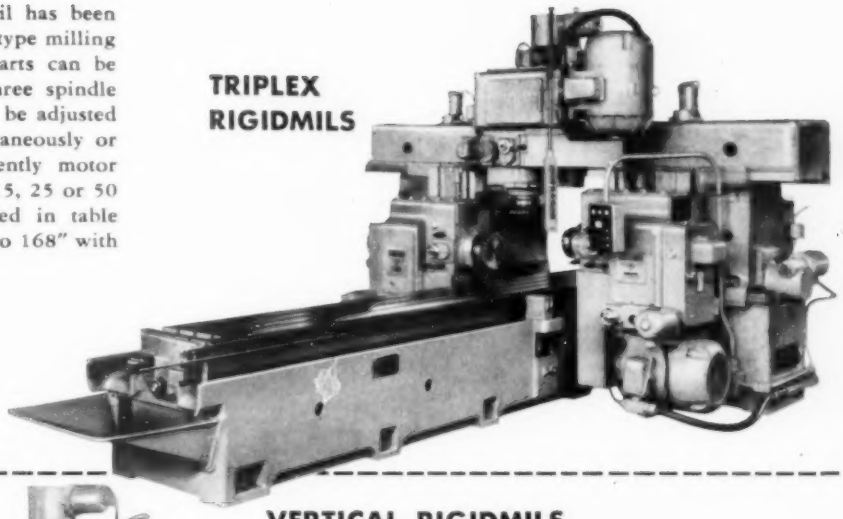


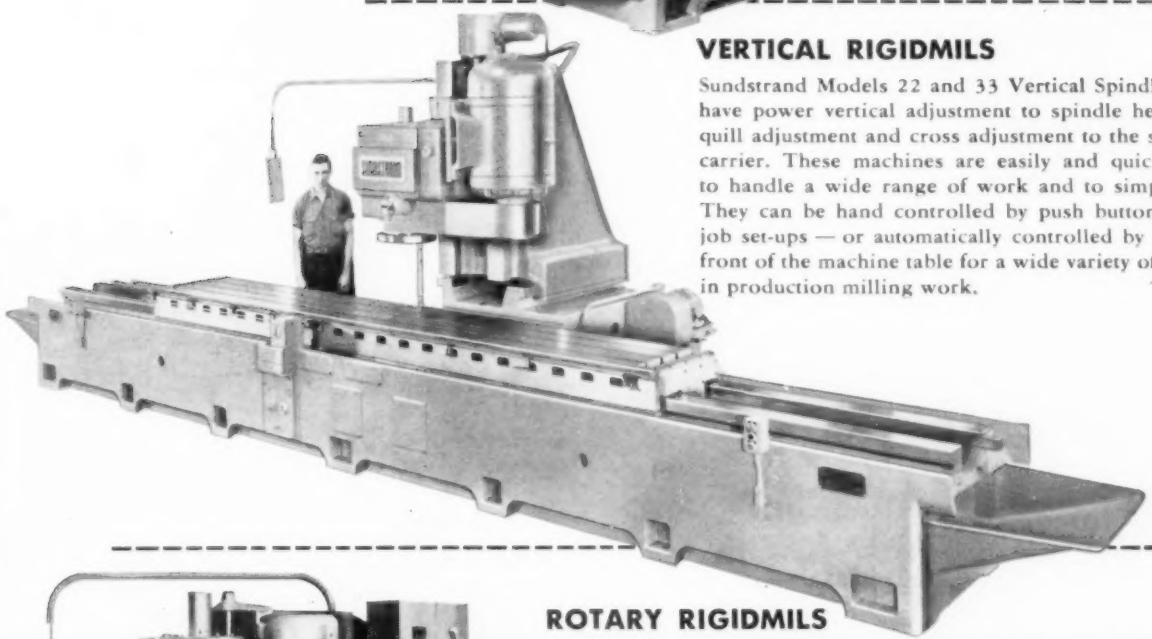




The highly productive Sundstrand Rigidmil has been developed to add flexibility to a production type milling machine so that both wide and narrow parts can be machined without sacrifice in accuracy. Three spindle heads, one vertical and two horizontal, can be adjusted to mill three sides of a work piece simultaneously or operate individually. Heads are independently motor driven and each can be furnished in either 15, 25 or 50 H.P. capacities. Machines can be furnished in table widths of 24" and 30" and feed strokes up to 168" with larger or special sizes available on request.

## TRIPLEX RIGIDMILS





## VERTICAL RIGIDMILS

Sundstrand Models 22 and 33 Vertical Spindle Rigidmils have power vertical adjustment to spindle head, endwise quill adjustment and cross adjustment to the spindle head carrier. These machines are easily and quickly adjusted to handle a wide range of work and to simplify set-ups. They can be hand controlled by push buttons for single job set-ups — or automatically controlled by dogs on the front of the machine table for a wide variety of table cycles in production milling work.

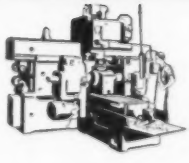
## ROTARY RIGIDMILS

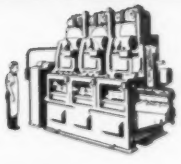
Sundstrand Rotary Rigidmils are available in three standard sizes with 36" and 48" diameter tables. They have way type cross adjustment of the spindle head carrier and way type vertical adjustment to the spindle head to provide maximum cutter support for either large or small parts. The adjustable swinging pendant permits easy access to the machine controls from any operating position. Power adjustment is optional for both the spindle head and the spindle head carrier.

**Free Data**

Free Data on each of these Sundstrand Rigidmils is available on request. Complete specifications are included. Ask for bulletin No. 739.

TRIPLEX RIGIDMILS | SPECIAL MACHINES





**SUNDSTRAND**
**Machine Tool Co.**
2540 Eleventh St. • Rockford, Ill., U.S.A.

# PYLE NATIONAL INCREASES PRODUCTION 47%!

## Soldering Of Spring Assemblies Speeded By *LINDBERG* Induction Heating Unit

An hourly production increase of 47% . . and a per-operator production increase of 330% through the use of a Lindberg Induction Heating Unit! These are the money saving facts and figures reported by Pyle National Co., Chicago manufacturer of electrical components.

The company uses a 10 KW Lindberg unit for the production soldering of flanges to coil springs in the manufacture of torsion spring assemblies. The time cycle is 11 seconds for each assembly.

Production has been increased to 125 assemblies an hour . . with one girl operating the equipment. This is an hourly increase of 40 assemblies over the former method where soldering was done by a team of three men using gas torches. And the hourly per-operator production is up from 28 to 125!

With the induction heating unit, there are no open flames from gas torches. No extra exhaust fans are required . . there is little danger of burns to operators . . fire hazards are virtually eliminated!

And there is a substantial economy of floor space! Formerly the three torch operators required more than 60 square feet of floor space . . but the Lindberg Induction Heating Unit requires less than 30 square feet.

If your requirements call for production soldering, brazing, hardening, annealing, stress relieving, hot forming, forging or shrink fitting, investigate Lindberg Induction Heating Units. Ask for Bulletin 1440.

These parts . .
plus this ring of soft solder . .
go through the
Lindberg Induction Heating Unit
to make this
torsion spring assembly . .

**LINDBERG**

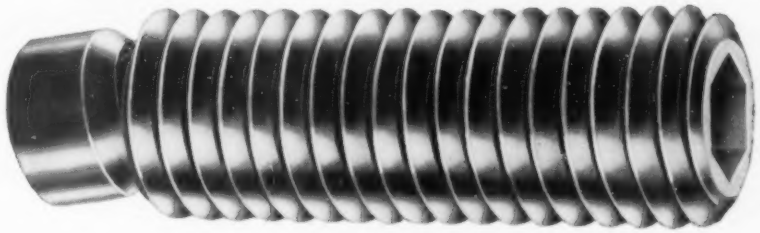
**HIGH FREQUENCY DIVISION**

LINDBERG ENGINEERING COMPANY,
2450 West Hubbard Street, Chicago 12, Illinois

# Available screw-ball clamp

**SAFELY CLAMPS VALUABLE PARTS...AUTOMATICALLY SELF-ALIGNING**

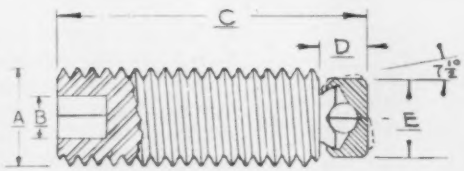
## *Ball Bearing Construction Insures Frictionless Automatic Angle Adjustment and Rotation*



PATENT APPLIED FOR

**USE STANDARD HEX KEY FOR WRENCH**

### SPECIFICATIONS




| ITEM NO. | A* | B (HEX) | C | D | E | LOAD LBS. |
|---|---|---|---|---|---|---|
| SC-333 | 5/16-18 | 5/32 | 1 | .167 | .240 | 2290 |
| SC-334 | 5/16-18 | 5/32 | 1 ½ | .167 | .240 | 2290 |
| SC-335 | 5/16-18 | 5/32 | 2 | .167 | .240 | 2290 |
| SC-339 | 3/8-16 | 3/16 | 1 | .205 | .293 | 3340 |
| SC-340 | 3/8-16 | 3/16 | 1 ½ | .205 | .293 | 3340 |
| SC-341 | 3/8-16 | 3/16 | 2 | .205 | .293 | 3340 |
| SC-346 | 1/2-13 | 1/4 | 1 ½ | .283 | .400 | 7300 |
| SC-347 | 1/2-13 | 1/4 | 2 | .283 | .400 | 7300 |
| SC-351 | 5/8-11 | 5/16 | 2 | .326 | .506 | 11700 |

*ALL THREADS ARE NATIONAL COURSE — CLASS 2 FIT

- **ELIMINATES DAMAGE AND MARRING** . . . which occurs when the ordinary holding pad is not at 90° to clamped surface.
- **GREATER EFFECTIVE AREA** . . . The SCREW-BALL CLAMP automatically adjusts itself to distribute uniform pressure on work over entire pad area at all times.
- **ROTATIONAL AND AXIAL FREEDOM** . . . a highly polished steel ball provides almost frictionless bearing surface for both rotation and oscillation.
- **SINGLE UNIT CONSTRUCTION** . . . Pad will pass through tapped hole from either end. Saves costly installation time. Ideal for cramped interiors. *Universally adaptable for all types of fixture work.*
- **HEX SOCKET END** . . . permits full utilization of screw length and minimizes projection interference — uses standard Hex Key for wrench which simplifies pressure adjustments.
- **ECONOMICAL** . . . screw portion machined from heat-treated alloy steel for long life and high strength. Rust-proofed to prevent deterioration in stock or freezing in fixtures — may be reused again and again. Contact surface of pad is of sufficiently soft material to prevent marring work.

**VLIER ENGINEERING INCORPORATED**

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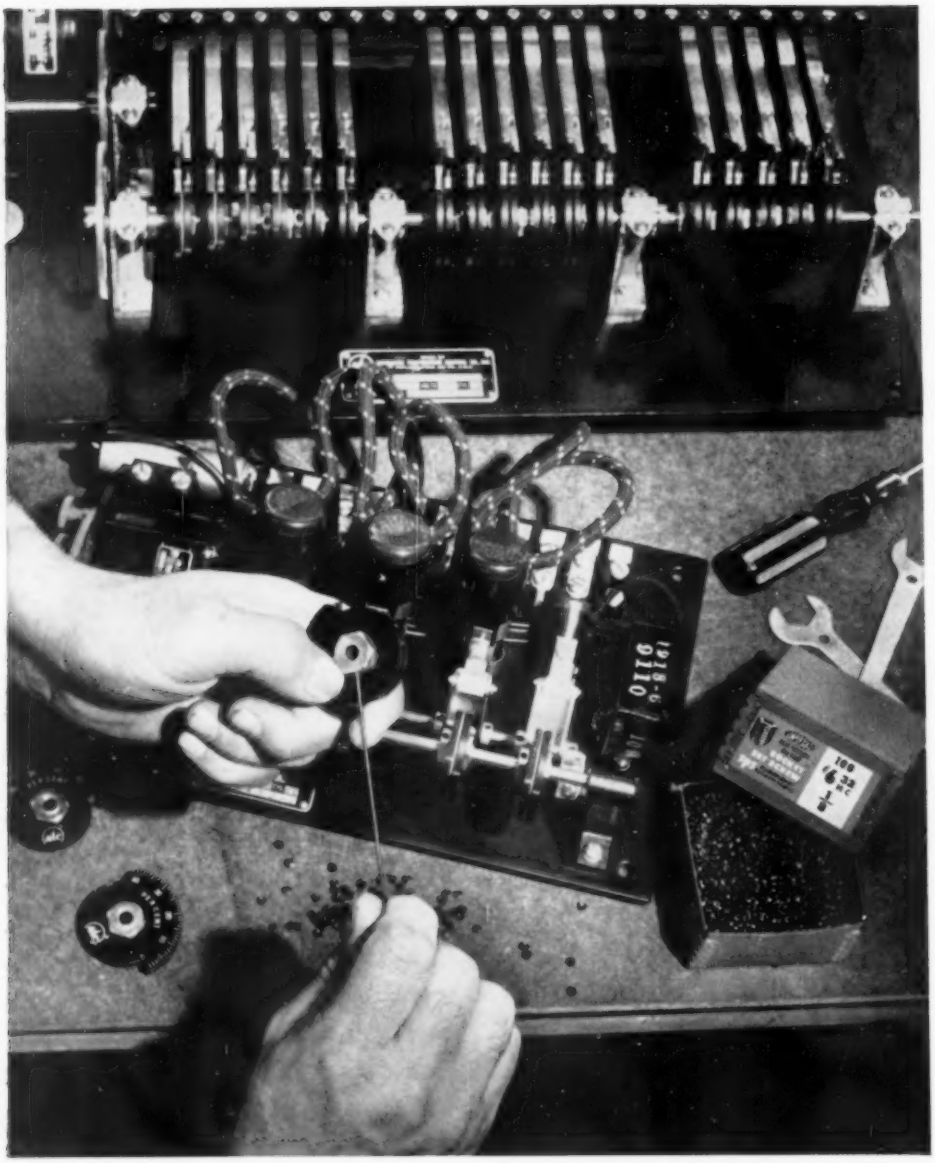
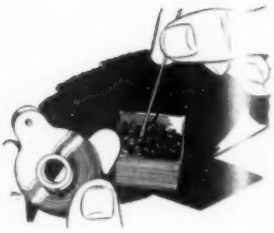
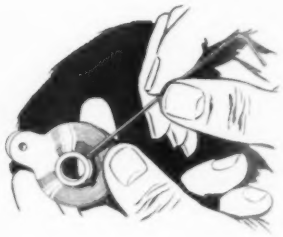
TORQUE THUMB SCREWS • SPRING PLUNGERS • SPRING STOPS • FIXTURE KEYS • TOGGLE PADS



**Two UNBRAKO Self-Locking Socket Set Screws** are used on each cam of these precision multicircuit cam timers. The screws position the cams so as to control accurately the sequence and duration of one or a series of individually timed machine or process operations.



Assembler picks up tiny UNBRAKO set screw with long arm key preparatory to threading it into cam assembly.



He inserts the UNBRAKO, and turns it into the assembly; then after positioning cam, tightens it. The accurate depth and size of the hex socket result in maximum torquing—the knurled cup point holds the cam accurately in place.

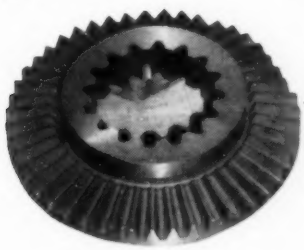
UNBRAKOS—made of heat treated alloy steel—have fully formed threads, Class 3 fit; are supplied in standard sizes from # 4 to 1".

## You'll need less space for storage when you use UNBRAKO Standards—stocked by your distributor

You'll need less space for storage and be able to carry a smaller inventory, because standard UNBRAKO socket screw products are in stock at your local industrial distributor's. And you'll save time and money, because deliveries are prompt. For more information, write for UNBRAKO Standards—a complete listing of socket screw products made by the world's largest manufacturer of these precision fasteners. STANDARD PRESSED STEEL Co., Jenkintown 37, Pa.

UNBRAKO® SOCKET SCREW DIVISION

SPS JENKINTOWN PENNSYLVANIA



## *what size broach do you need?*

# *American* HAS THE ANSWER

*American* **makes all three —**
**Broaches, Fixtures, Machines**

Whether it is a large involute spline broach or a small round broach, you stand a better chance of getting a broach fitted to your needs when you specify American. American builds all three — tools, fixtures and machines. When you bring your broaching problem to them they approach it from the over-all view.

For American's quotation on your broaching problem, send a part-print and hourly requirements today. Address Dept. T

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A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

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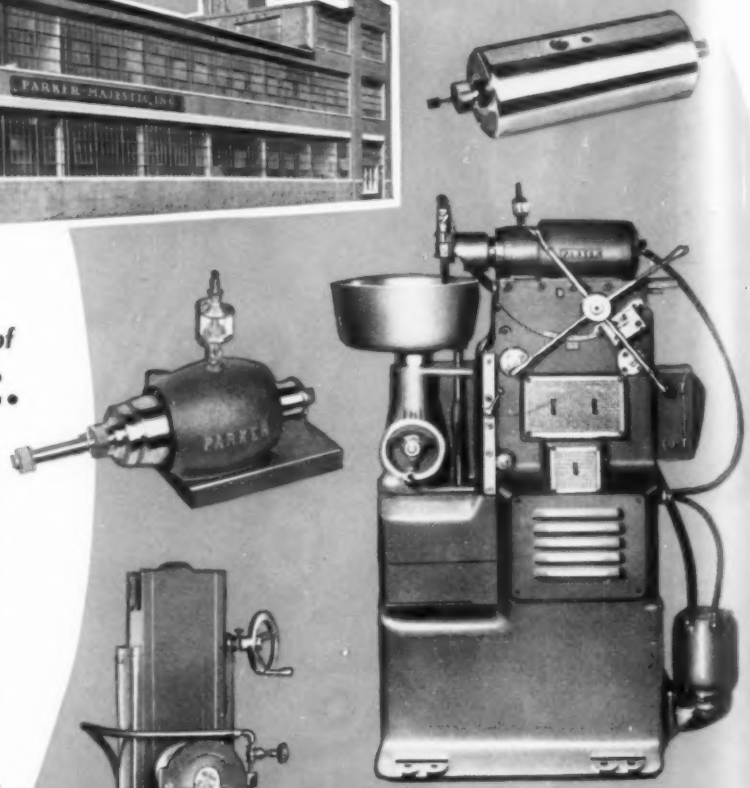
PARKER • MAJESTIC PM PRECISION MACHINES

*Pictured here is the home and products of*

## PARKER-MAJESTIC, INC.

For almost a quarter of a century this company has manufactured the **Parker** Spindles used in Precision Grinding, Boring and Milling applications. Additional products include the well known line of **Parker-Majestic** Internal, External, No. 2 Surface and Rotary Surface Grinders.

***Descriptive literature upon request.***



**PARKER-MAJESTIC, INC.**

formerly **MAJESTIC TOOL & MFG. CO.**

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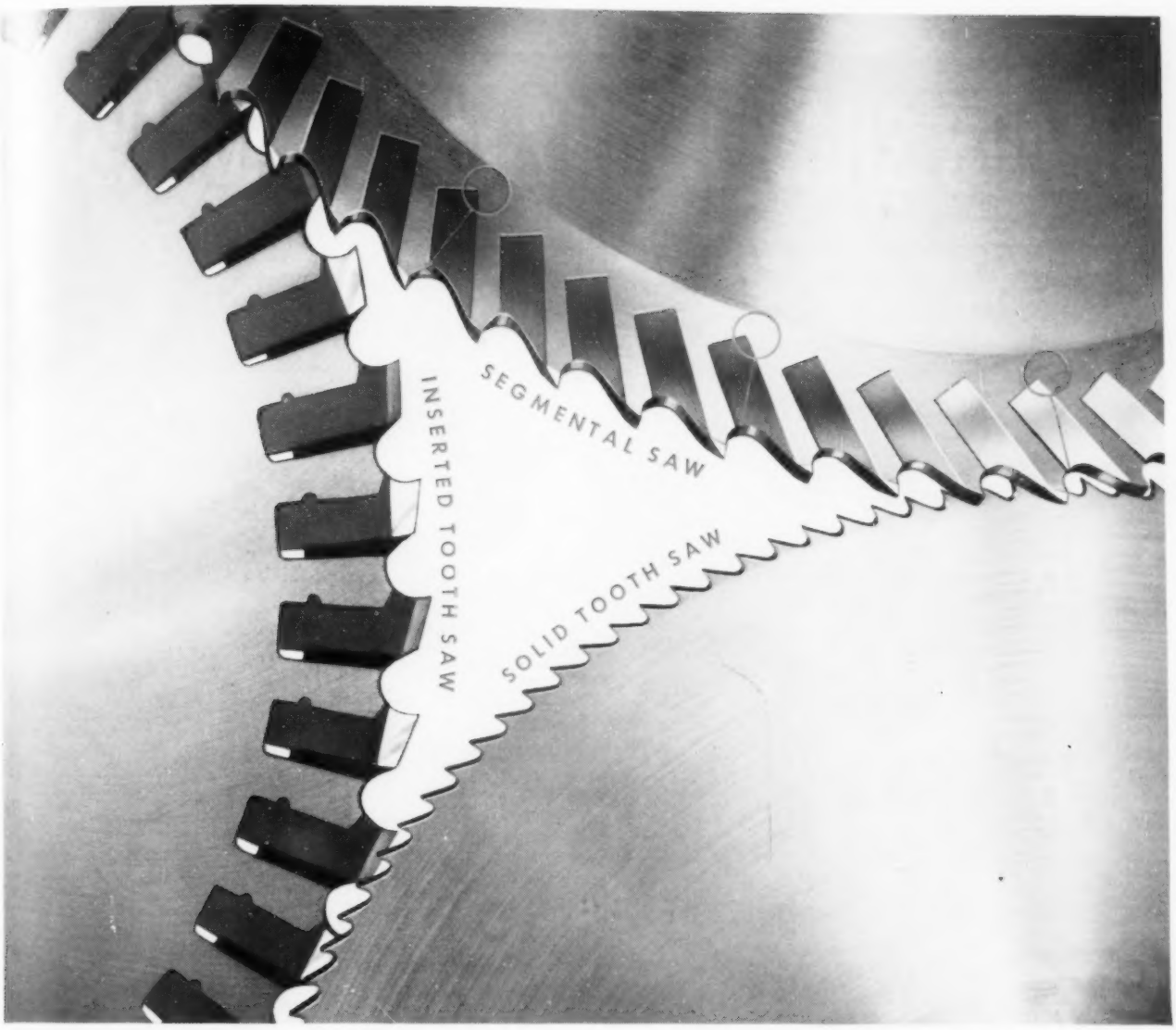


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## For the best saw-performance on your job... SIMONDS gives you a choice of *All 3 Types!*

**INSERTED TOOTH:** For heavy production cutting of all steel, brass, copper, and aluminum. Alternating square and beveled teeth "tri-vide" chips for easy cutting and clearance. Teeth can be easily replaced, singly or in complete sets, in your own plant by any average mechanic.

**SOLID TOOTH:** For general shop cut-off jobs . . . for use on smaller automatic cut-off machines and for cutting jobs where narrow kerf is important.

**SEGMENTAL:** For especially smooth cuts on production work. High Speed steel toothed segments are securely held in a tough alloy plate by a special tongue and groove design, have quick clearance for faster, freer cutting.

SIMONDS MAKES ALL THREE TYPES OF CIRCULAR METAL-CUTTING SAWS. So you can be sure that SIMONDS will give you *the right saw for your job* . . . for any type of machine. See your Simonds Distributor today, or write the nearest Simonds Office.

**SIMONDS**
**SAW AND STEEL CO.**
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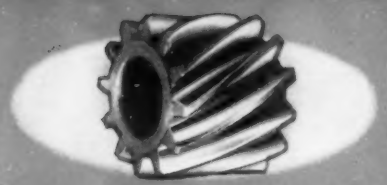
*Simonds Divisions: Simonds Steel Mill, Lockport, N. Y., Simonds Abrasive Co., Phila., Pa. and Arvida, Que., Canada*

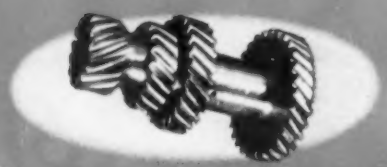
# GEARS SHAVED in 12 to 20 SECONDS

**Finishing precision gears to close tolerances on tooth profile, index, eccentricity and tooth surface smoothness on Red Ring Shaving Machines is a high production operation as indicated by these random examples.**

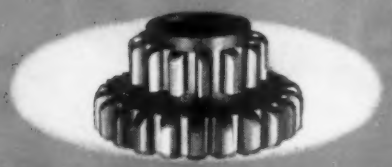
**A** SHAVING TIME 16 SECONDS



**D** SHAVING TIME 12 SECONDS



**B** SHAVING TIME 16 SECONDS



**E** SHAVING TIME 15 SECONDS

**C** SHAVING TIME 20 SECONDS

**F** SHAVING TIME 20 SECONDS

## GEAR CHARACTERISTICS

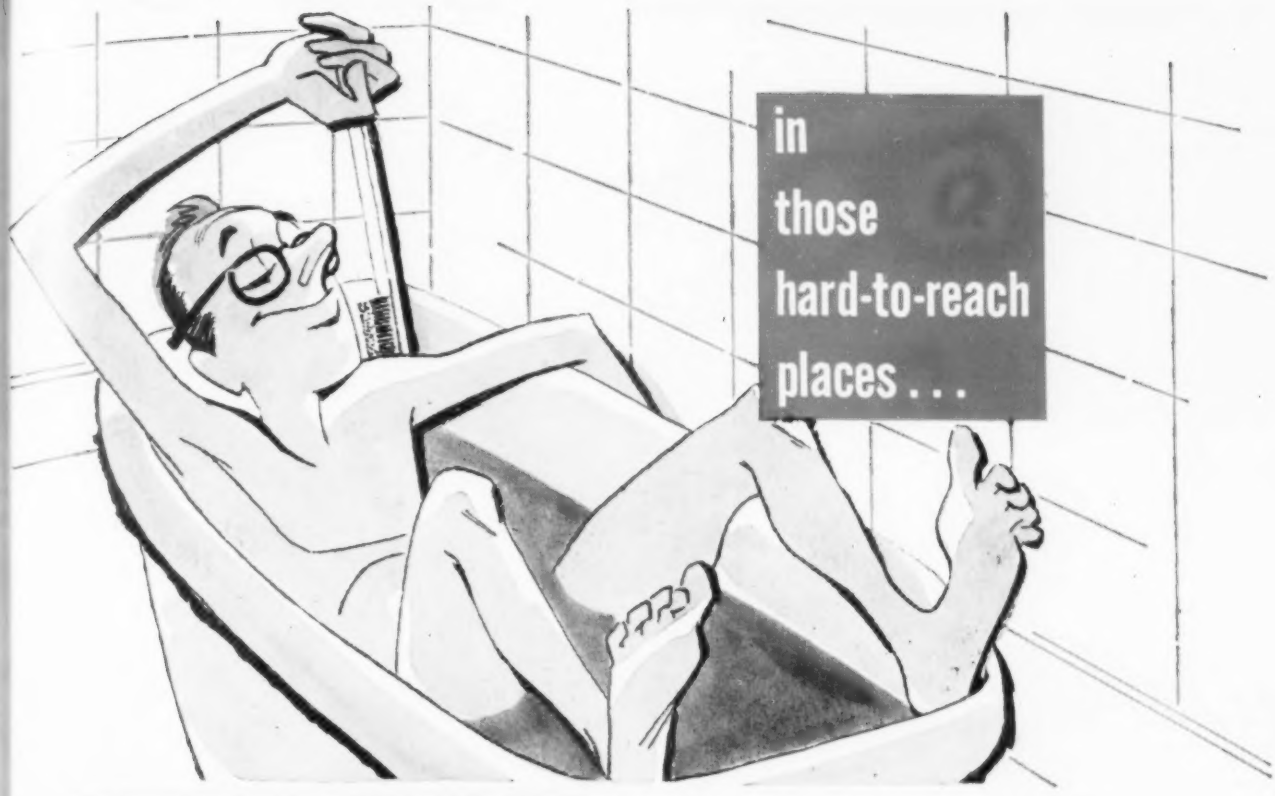
| Gear | Stock Removed Over Pins | Material | No. of Teeth | PD | DP | Face Width |
|---|---|---|---|---|---|---|
| A | .010″ | Steel | 19 | 2.4″ | 9.25 | 5/8″ |
| B | .010″ | Steel | 29 | 4.00 | 9.25 | 1¼″ |
| C | .010″ | Cast Iron | 28 | 2¾″ | 10 | 1⅛″ |
| D | .005″ | Steel | 12 | 1⅛″ | 13.5 | 1″ |
| E | .006″ | Steel | 14 | 2¼″ | 6/8 | 1⅛″ |
| F | .012″ | Aluminum | 54 | 5⅞″ | 10 | ⅞″ |

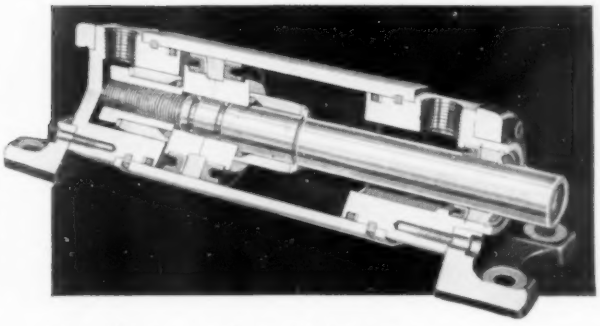
WRITE FOR DESCRIPTIVE LITERATURE ON *Red Ring Gear Shaving*

**NATIONAL BROACH & MACHINE CO.**

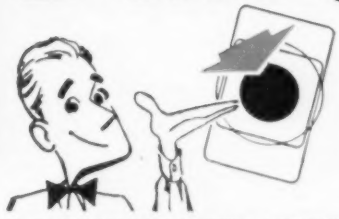
5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT



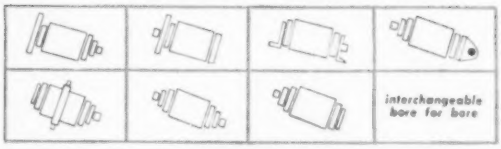



# O-M (air • hydraulic) CYLINDERS



fit where others won't!

complete range of mounting brackets




***O-M's SPECIAL INTERLOCKING MECHANISM,*** which does away with projecting tie rods and end caps, answers the old problem of how to get the necessary power when space is a factor. O-M Cylinders require 1/3 *less installation space* than conventional cylinders with the same bore . . . and can be turned down to fit easily into the deep recesses of machine bases and equally hard-to-reach spots. They're ALL-STEEL with bearing bronze—no castings.

***And O-M has the lowest coefficient of friction*** of *any* cylinder . . . smoother operating at low or high speeds regardless of length of stroke. End plugs tapped for universal mounting. Any one or combination of mounting brackets may be used to install *without disassembling or changing cylinder.* Easily removed, inspected, repaired.

***Available in a full range of sizes*** (1½ to 8" bores) with standard, 2 to 1 or oversize rods. Completely interchangeable parts.

***Write today for FREE catalog*** and complete set of ½- and ¼-scale templates showing all cylinders and mounting brackets.

*14 day delivery on most sizes*

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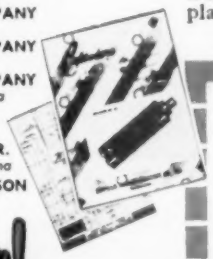

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**1216 150th Street, Hammond, Indiana**

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Name_____ Position_____

Company_____

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*"Now with a G Bond wheel we can go completely around a 16-inch face mill,"* writes the tool supervisor of a New Jersey plant. "Previously, due to wheel wear we had to index this type of cutter at four different positions. Now, on a finish cut, we can go completely around, and the cutter runs absolutely true within .0005 inches. These new G Bond wheels have very good, cool cutting action, don't break down or leave jagged edges . . . We'll be using plenty of them on our tool room jobs."

# New G BOND sets new records in tool room grinding

## *Here's Proof... Users praise the many* "TOUCH of GOLD" *advantages in Norton pace-setting wheels*

Norton G Bond wheels have sure started something! In tool and cutter grinding, as in many other forms of precision and semi-precision grinding, they're giving users an entirely new slant on how efficient, long-lasting and profitable wheels can be.

### *What Users Say About New G Bond Wheels*

**"Good finish, longer wheel life."**

**"Heavier feeds without burn."**

**"Run absolutely true."**

**"No breakdown—no jagged edges."**

**"Cut freely, hold shape with no burning."**

**"They show how a real wheel will cut."**

### *G Bond Alundum* Wheels In Your Own Tool Room*

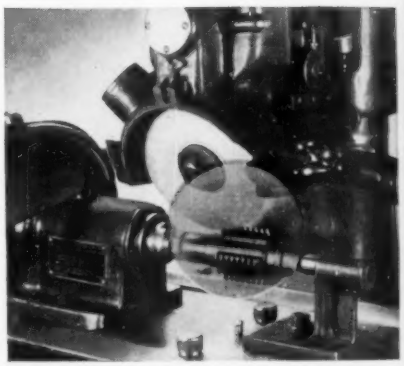
will take heavier cuts in expensive, heat-sensitive steels without drawing temper. They'll reduce tool spoilage, give you closer tolerances and smoother finishes than you ever got before — with fewer wheel changes and machine adjustments . . . Those are the value-adding, money-saving "Touch of Gold" advantages that make G Bond wheels outperform any others you ever used.

### *Your Norton Distributor*

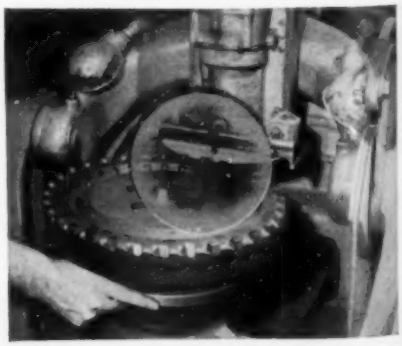
can recommend the right G Bond wheels for your jobs. Contact him or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities, listed under "Grinding Wheels" in your classified phone directory. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass. W-1532

NORTON
ABRASIVES
*Making better products... to make other products better*

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries



*"Better cut and less burn* than previous Norton or other make wheels. We're re-ordering 250 G Bond wheels," was the comment from this Ohio tool company.



*"We're using heavier feeds* with G Bond wheels — and getting faster sharpening."

# NEW!

## THE MODERN TYPE M STUD SETTER*

# *A Better Stud Setter for Better Stud Setting!*

**Details on Request*

## MODERN TOOL WORKS

DIVISION

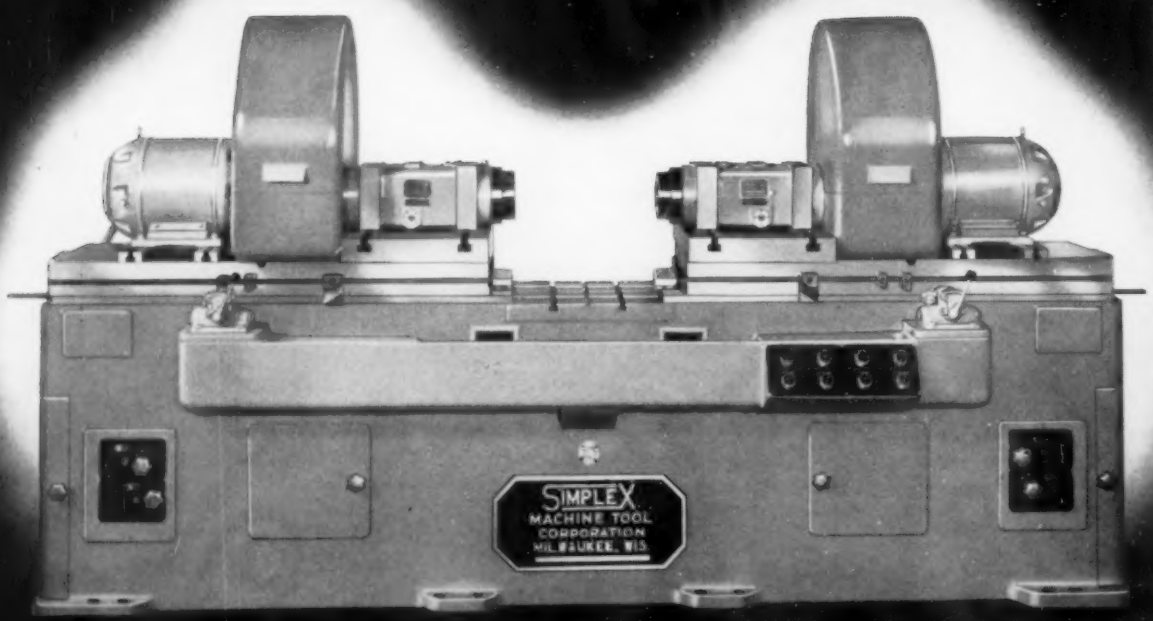
**CONSOLIDATED MACHINE TOOL CORPORATION**

WHOLLY OWNED SUBSIDIARY OF FARREL-BIRMINGHAM COMPANY, INCORPORATED

**ROCHESTER, NEW YORK**

# Simplex

## PRECISION BORING MACHINES




Standard SIMPLEX 2U 2-Way Hydraulic Feed Precision Boring Machine complete with two #4 SIMPLEX Precision Boring Heads. Other sizes of Mechanical and Unit Type Hydraulic Machines also available.

**SIMPLEX MACHINE TOOL CORPORATION**

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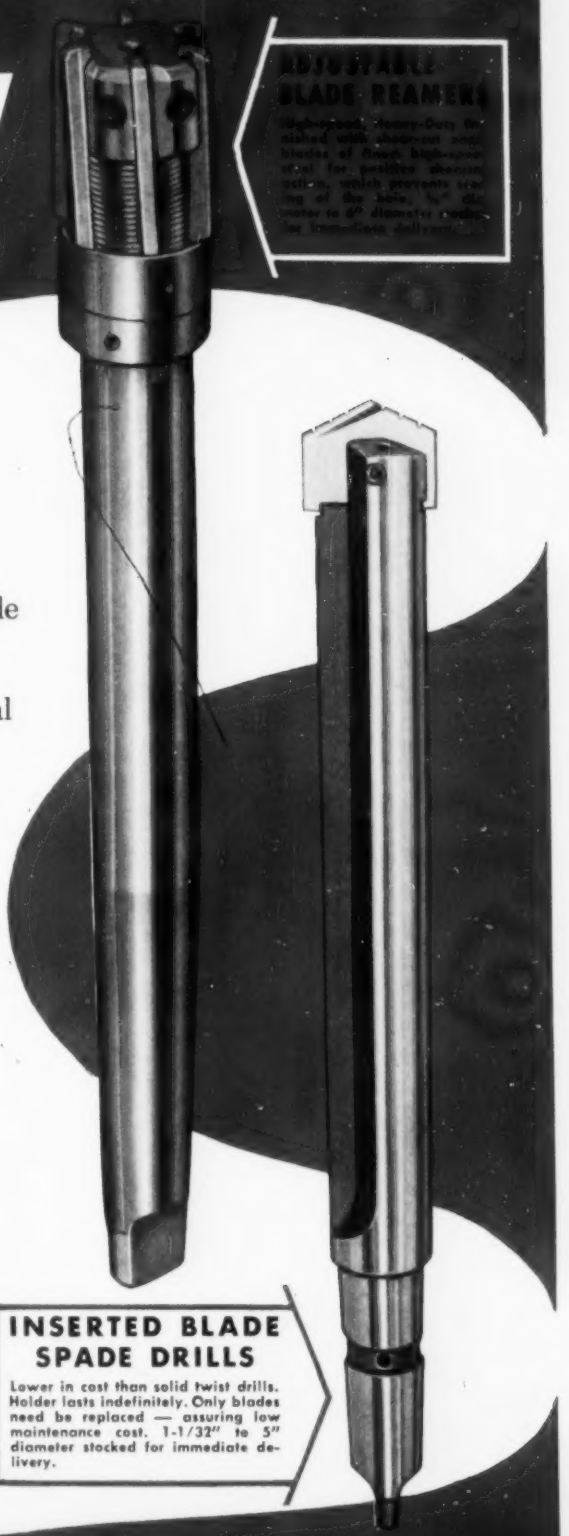
**MILWAUKEE, WISCONSIN**

PRECISION BORING MACHINES • PLANER TYPE MILLING MACHINES
SPECIAL DRILLING, TAPPING AND BORING MACHINES

# "Standards" by WAUKESHA



**ADJUSTABLE BLADE REAMERS**

Highspeed Heavy-Duty Reamers with shearcut spiral blades of finest highspeed steel for positive shearing action, which prevents work-ing of the hole, even at center in 6" diameter reamer, for immediate delivery.

## . . . meet most of your Cutting Tool Needs . . . most of the time!

The use of Waukesha Standard Inserted Blade Reamers, Spade Drills and Counterbores eliminates substantial investments in "special tooling". The adjustability, adaptability and ready availability of standard Waukesha Cutting Tools save costly engineering time, eliminate down time for new tooling. You can make savings in your cutting tool costs by specifying Standard WAUKESHA Cutting Tools.

### consult WAUKESHA

. . . for competent cutting tool counsel. Waukesha sales representatives and engineers are qualified to work with your own staff in adapting standard Waukesha Tools to your needs . . . or in the development of special cutting tools.

**INSERTED BLADE SPADE DRILLS**

Lower in cost than solid twist drills. Holder lasts indefinitely. Only blades need be replaced — assuring low maintenance cost. 1-1/32" to 5" diameter stocked for immediate delivery.

WAUKESHA TOOL CO. WAUKESHA, WISCONSIN

Manufacturers of Carbide and High Speed INSERTED BLADE REAMERS • SPADE DRILLS • TAP DRIVERS BORING BARS • INSERTED BLADE COUNTERBORES • FLOATING TOOL HOLDERS • SPECIAL TOOLS

A7735-1P



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Depend On

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NATIONAL Tools CLEVELAND

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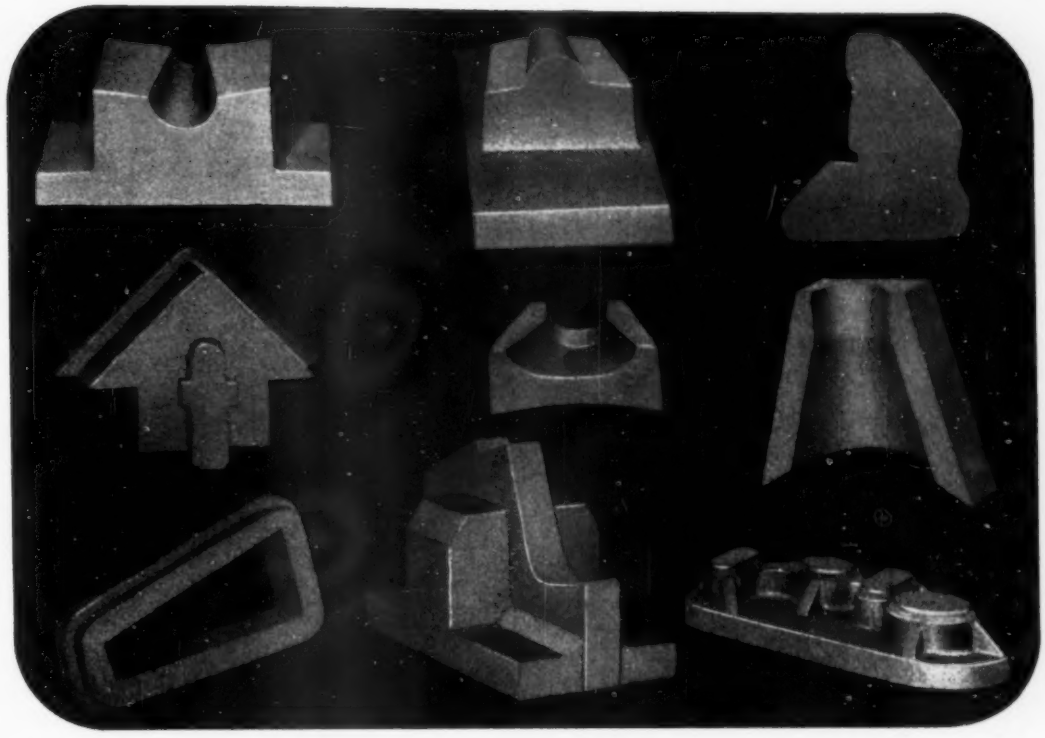
Cleveland 2, Ohio



# *In this method*

## of Tool and Die Making —you Buy Less Steel and Reduce Machining Costs

**Write for New Booklet:**

**CAST-TO-SHAPE**

**TOOL STEEL**

Gives you full details on FCC Air Hardening, Oil Hardening and other Cast-To-Shape Tool Steel Specialties capable of saving you time and money.

**Get Your Copy— Write for it Today**

**ADDRESS DEPT. TE-49**

FCC Cast-To-Shape, the modern method of tool and die making, is effecting important savings of time, trouble and money for an increasing number of manufacturers.

Even very intricate shapes can now be cast successfully within an eighth inch of finished size. This means that you buy less steel at the start and reduce machining costs substantially.

Tools which could not be made by conventional methods except in sections can often be fabricated from FCC Cast-To-Shape blanks in a single piece.

In many instances performance of the tool is better than can be obtained by fabrication from bar stock or forgings.

Particulars are available through Allegheny Ludlum representatives; or write for the booklet today.

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For complete **MODERN** Tooling, call

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# Where can you SAVE with STATIC BALANCING

You wouldn't buy a 10-ton truck to haul 1-ton loads!

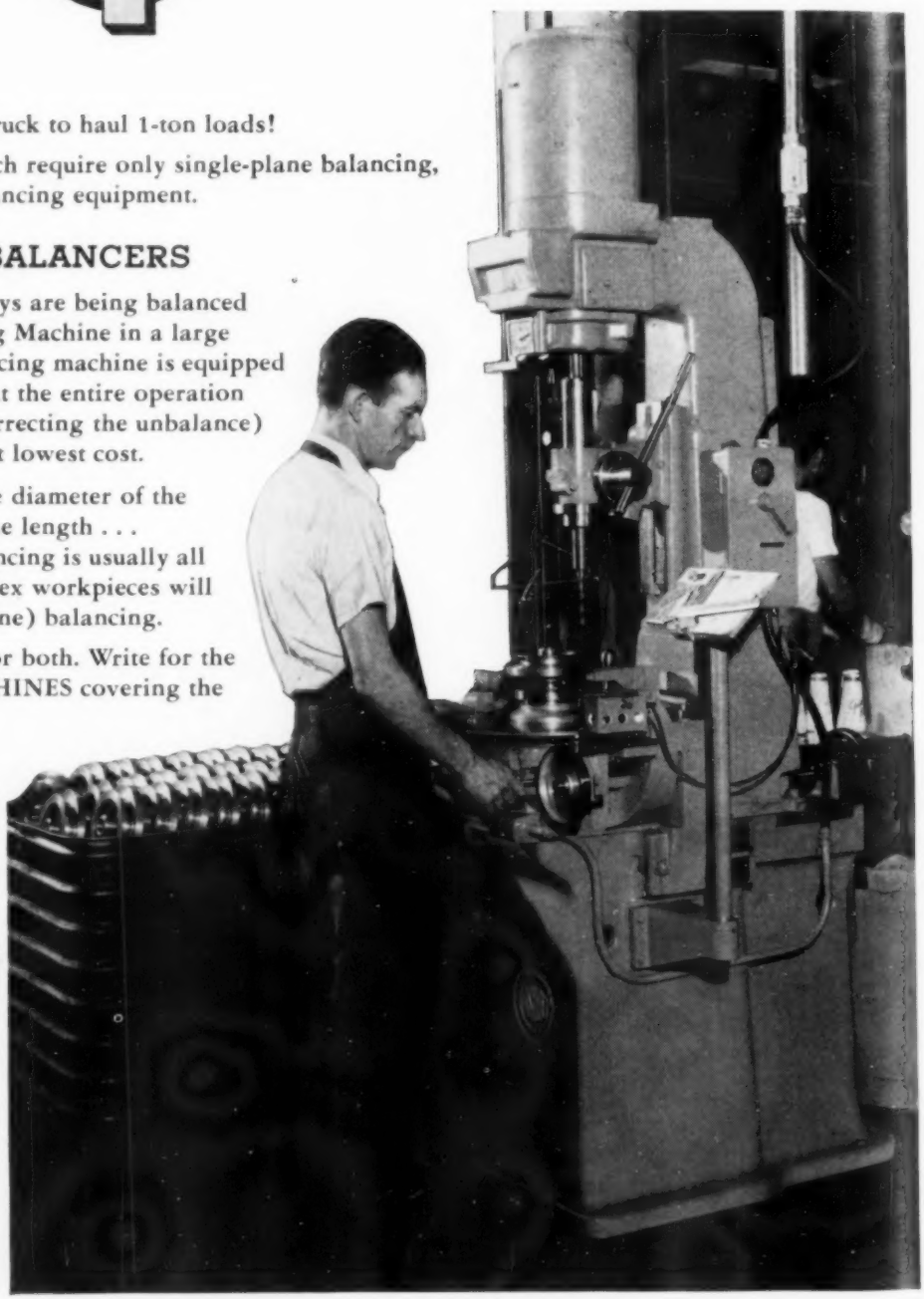
And if you have parts which require only single-plane balancing, you don't need dynamic balancing equipment.

## GISHOLT STATIC BALANCERS

*For Example:* These fan pulleys are being balanced on a Gisholt Static Balancing Machine in a large automobile plant. The balancing machine is equipped with a correction drill so that the entire operation (measuring, locating and correcting the unbalance) is handled at one time and at lowest cost.

***Remember:*** When the diameter of the workpiece greatly exceeds the length . . . Static (or single-plane) balancing is usually all that is required. More complex workpieces will require dynamic (or two-plane) balancing.

Gisholt builds machines for both. Write for the catalog BALANCING MACHINES covering the full line.



**THE GISHOLT ROUND TABLE** *represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.*

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*Madison 10, Wisconsin*

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"It can't be done.

**You can't drill small holes and large holes at the same feed and speed."**

"Well, let's see.

**What do you pay off on? Feed? No! Speed? No! Production? YES!! —on your tooling cost and finished parts per hour."**

# DON'T YOU AGREE?

## EXAMPLE (and it's extreme)

Drill stand has 30 holes 1/16" through 1/2" diameter. Completely drilled in two passes with two Zagar gearless drill heads, 16 spindles per head. All spindles run at 1200 r.p.m.

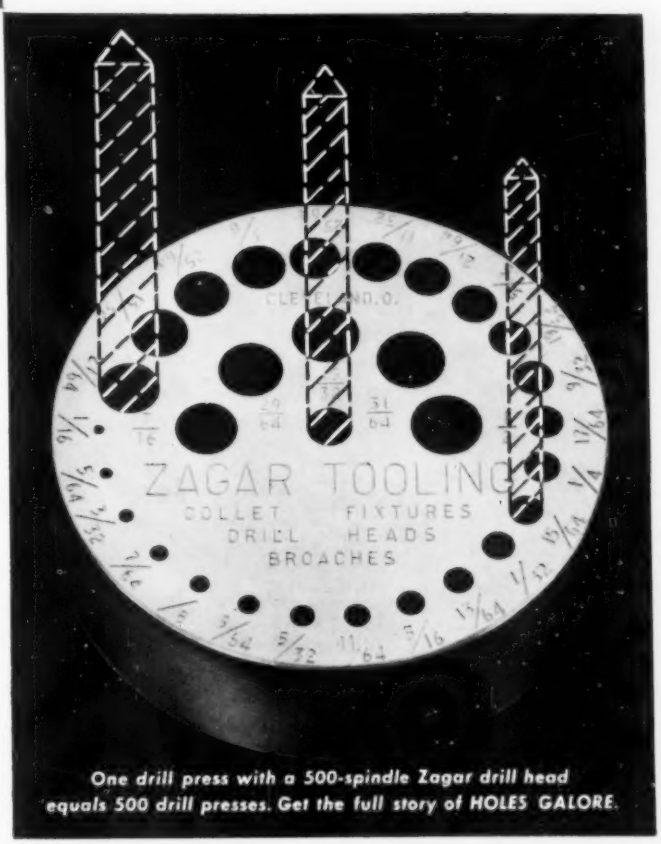
**Conventional multi-speed method.** So-called ideal speeds would be not less than three times as fast for the 1/16" drill as for the 1/2" drill. Ideal drill feed would be three times as heavy for the 1/2" as for the 1/16". Moreover, six passes would be necessary.

**Zagar single-speed method.** Only two passes. Feed is held down by strength of 1/16" drill, and speed is held down by 1/2" drill. Simplified operation; fewer indexes; far less handling. Production is at least tripled. Tooling costs drop enormously.

***If you don't agree, what's your version?***

★ ★ ★

*WRITE FOR CATALOG "E-1".*




*One drill press with a 500-spindle Zagar drill head equals 500 drill presses. Get the full story of HOLES GALORE.*

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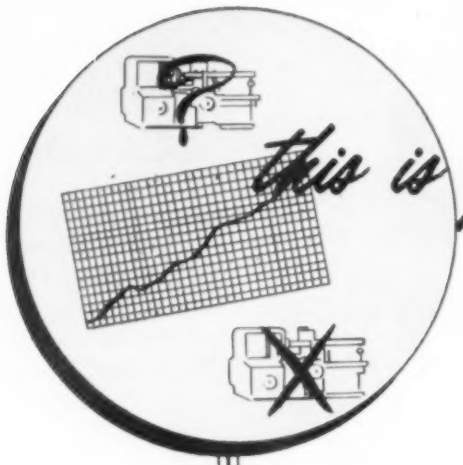
Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY



# this is your problem in 1954!

Industry is now planning the rejuvenation of its manufacturing processes and equipment for the competitive era ahead.*

It's a time-consuming job.

How can it be *speeded up* for you?

*see the 1953 ASTE Obsolescence Report.

## what ASTE is doing to help you

The American Society of Tool Engineers is assembling in Philadelphia's Convention Center on April 26 to 30 inclusive the latest in production equipment and processes available from over 450 manufacturers. The exhibits will be open to you and your key men during these five days, from 9:00 A.M. to 5:00 P.M. Included will be inspection and automation devices, machine tools, accessories, cutting tools, and allied equipment.

Simultaneously, a series of top-level Conferences will be held dealing with such major industrial problems as Plant Management, Automation, Precision Control, Metal Forming, and Assembly Methods.

## it's up to your key men NOW!

. . . whether your company moves forward or falls behind in the competitive era ahead. To help you select the key men in your organization who definitely should visit the Exposition, the ASTE has prepared a "plan booklet" which covers every aspect of the ASTE Exposition and Conferences. Write today for a copy on your company letterhead. It will be mailed to you promptly, free of charge.

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**CARLTON RADIAL DRILLS** cost less to maintain because they are *designed for less maintenance attention.* For example: there's only *one* friction clutch to adjust. There are *no* tapered gibs to adjust because the head travels across the arm on hardened steel ways. Automatic lubrication throughout eliminates the damage and unnecessary wear that occurs in ordinary radial drills.

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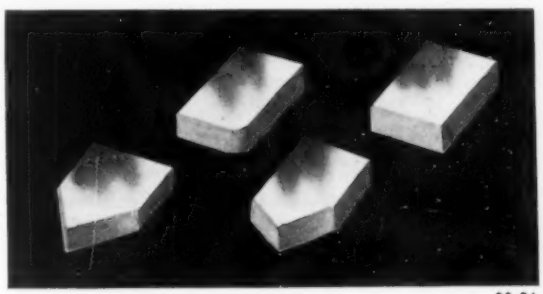
Tests show that SANDVIK COROMANT tungsten carbide tipped tools and blanks have a productive life that compares favorably with that of the best competitive brands. The reasons? – Basic purity of the raw material, intensive research and development plus close, unified control by SANDVIK from the tungsten mine to the finished tool.

COROMANT'S extra production performance has made it famous throughout European metalworking plants. This same cost-cutting advantage is now available to you:

- **In a wide variety of tools and blanks—including turning, boring, facing, threading and grooving tools, cutters, drills, reamers, scrapers, copying lathe tools and Swiss-type automatic tools, etc.**
- **In an unusually wide range of standard tool shapes and angles.**
- **In all standard grades to suit a wide range of applications and machine tools.**
- **Grade permanently color-identified on the end of tool shank.**



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*Make your own test of COROMANT'S money-saving performance. Contact Sandvik for further details.*

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# diamond

**FACT:** *in grinding carbides* — nothing cuts as fast, as cool and as economically as a diamond wheel.

**FACT:** *in drilling* — diamond bits give lowest cost per foot in hard geological formations.

**FACT:** *in dressing grinding wheels* only diamond dressers will do the job where fine finish, high production or intricate forms are involved.

**FACT:** *in wire drawing* — diamond dies assure accurate sizing, bright finish and high output.

**FACT:** *in lapping* — diamond compounds and powders save countless skilled man-hours by producing wanted sizes and finishes faster.

**FACT:** *in cutting* — diamond cutting and boring tools are standard for tough jobs where the best of competitive materials fail.

**FACT:** *in sawing* — diamond saw blades feature speed and economy on quartz, concrete, stone, sapphire, glass and diamond.

**FACT: Diamond Tooling gives you precise production, more production, uninterrupted production, *lowest cost production.***

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Taps, such as the ones shown here . . . hobs, twist drills, milling cutters, cut-off saws, etc., have shown work-life increases up to 1800% after Pressure Blasting! When high speed steel cutters wear, Pressure Blast and use again without grinding. After tools are ground, however, Pressure Blast immediately after grinding for removal of burrs, feather edges, directional lines and general polishing of the tool. Good for cleaning prior to hard chrome plate, too!

Before Pressure Blasting

After Pressure Blasting

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FREE . . . Learn what PRESSURE BLAST can do for you! Die and Mold Polishing, Blending Grind Lines, Deburring, Heat Treat Scale Removal, Honing of Cutting Tools, Pre-plating Cleaning . . . Hundreds of proven, money-saving applications!

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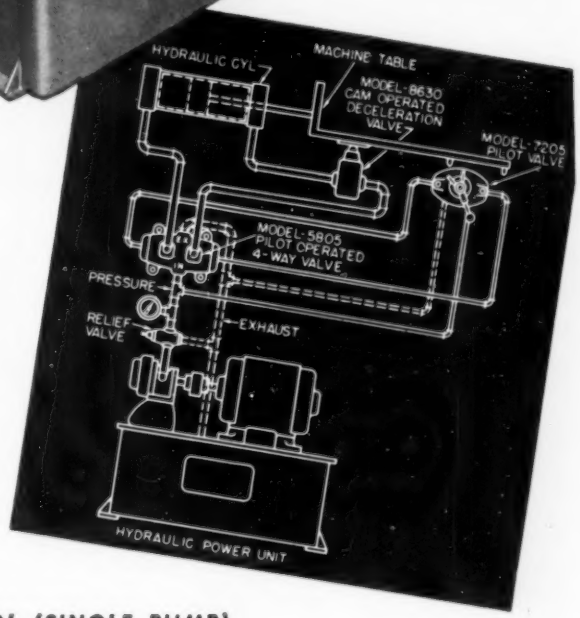
# Complete Package

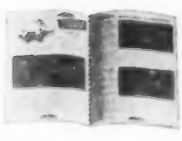
## —with a RIVETT POWER UNIT




Rivett offers the Series 9100 Power Unit as the ideal source of power for your hydraulic circuit. The unit is equipped with pump, relief valve, oil filter, pressure gauge, and all equipment to furnish a steady flow of oil at continuous working pressures up to 1000 P.S.I. Reservoir is available in 6 tank sizes, with pump capacities from .4 G.P.M. to 40 G.P.M. Motor mounting may be arranged for any standard frame. Series 9200 with double pumps are supplied for two separate circuits of different pressures.

### *REMOTE PILOT OPERATED CONTROL (SINGLE PUMP)*

Starting the electric motor results in the continuous reciprocating of the cylinder rod. In one position of the Model 5805 Pilot operated 4-Way valve, oil is directed from the pump to the blind end of the hydraulic cylinder, causing the cylinder to extend at its rated speed. When the machine table advances to where it depresses the cam of Model 8630 flow control valve, the forward speed of the cylinder is affected by the setting of the flow adjusting screw of Model 8630 valve. In the other position of Model 5805 valve, oil is directed from the pump to the rod end of the hydraulic cylinder causing it to retract at full rated speed. In this direction of cylinder movement, Model 8630 has no effect on the speed of the cylinder. Model 7205 Pilot valve provides for remote hydraulic operation of the main 4-Way valve, Model 5805. The forward, or return stroke of the cylinder may be manually interrupted at any time by reversing the handle of the Model 7205 Pilot valve.



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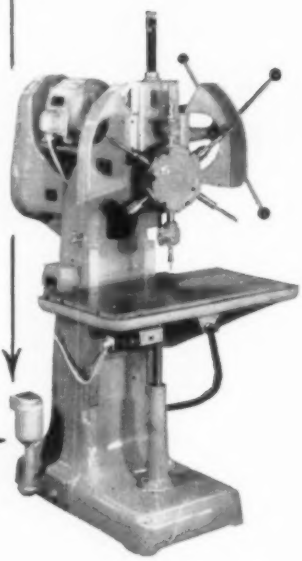
There is a Ruthman Gusher Coolant Pump to meet practically every coolant system requirement, with motor capacities from 1/10 to 2 H. P.

Each model has the same outstanding characteristics; simple construction with fewer parts to wear, dynamically balanced rotating shaft, pre-lubricated heavy-duty ball bearings, automatic priming with no packing foot or relief valves needed.

When you specify Ruthman Gusher Coolant Pumps you're sure they're right for the job. Write today for information on various models available.



Illustrated is a Burgmaster Drill equipped with a Gusher Coolant Pump. Photo, courtesy Burg Tool Co.

THE RUTHMAN MACHINERY CO.

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You'll find that it always floats freely, without friction or cramping, even under the severest tool-driving strains and takes any and all end-thrusts.

Try it out and see how much better work it will enable your machines to perform.

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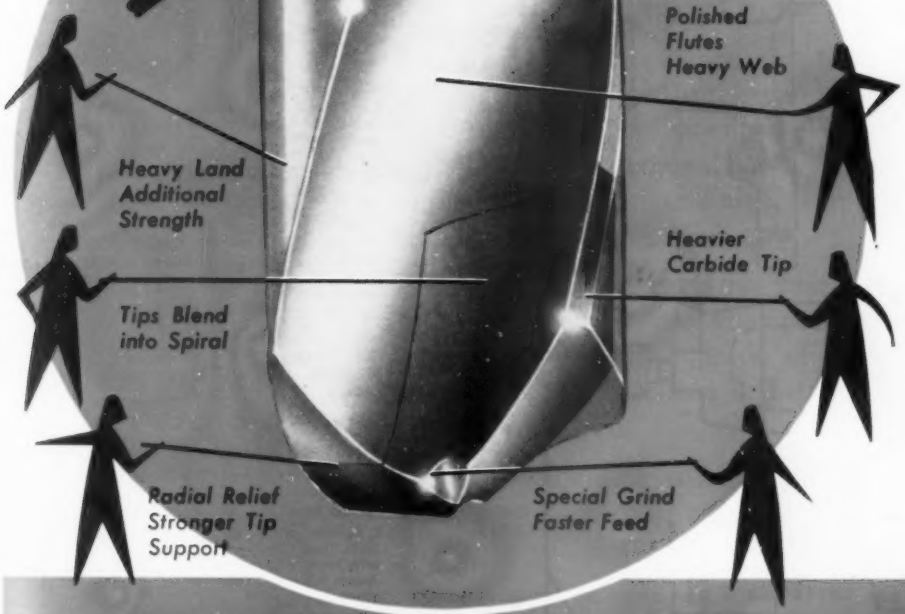
## NEW and really super!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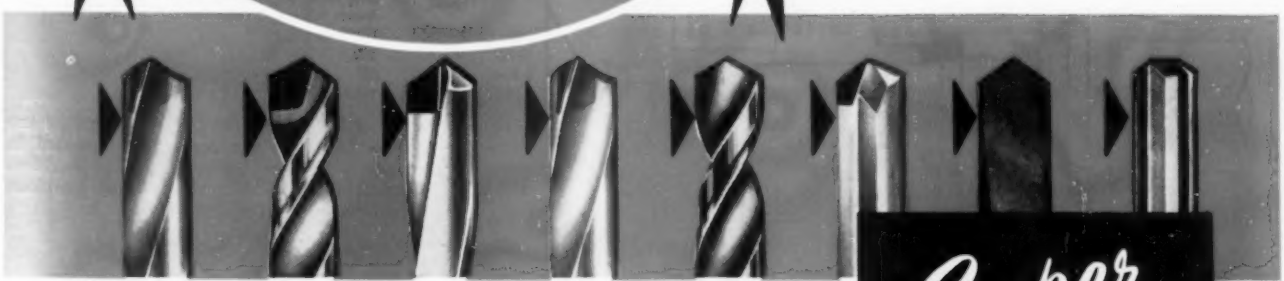

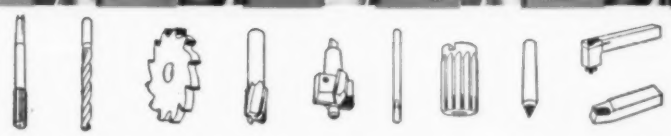

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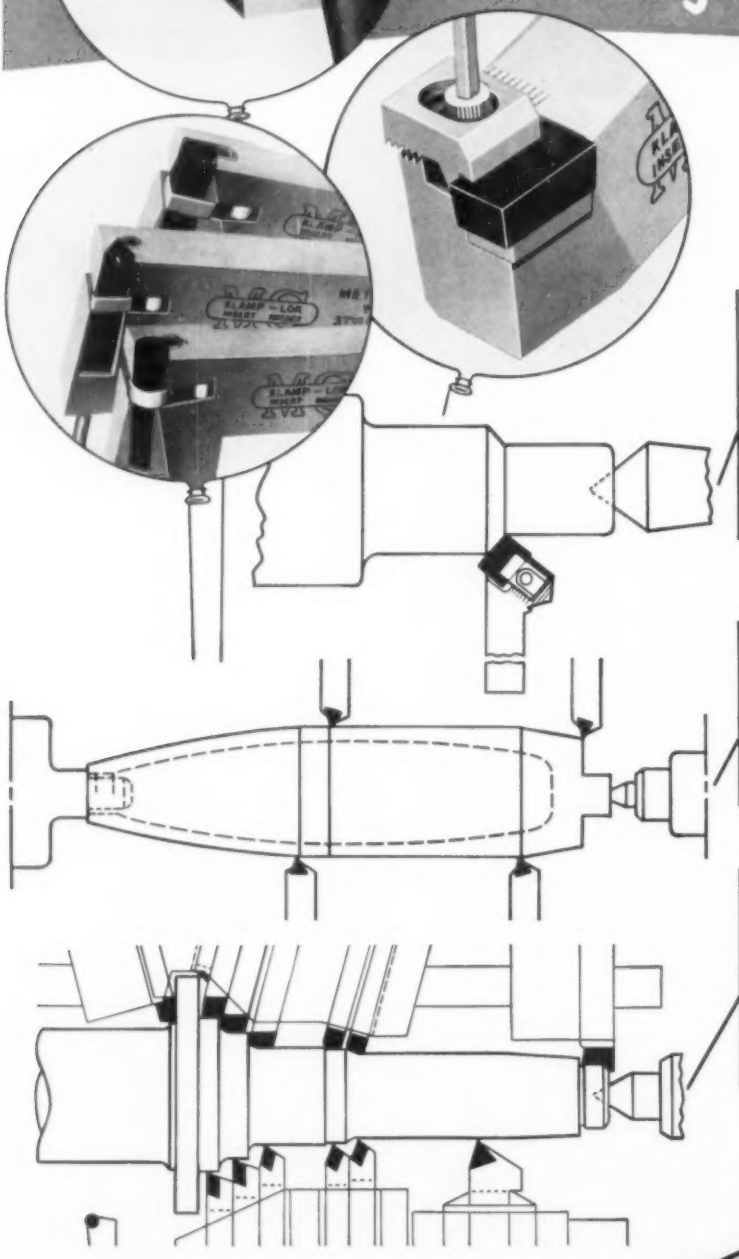

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| | |
|---|---|
| PART | SAE 52100 forged chrome steel mill roll 28" O.D. |
| OPERATION | Rough turn and finish machine roll necks and barrel. |
| MACHINE | 48" x 15' Mackintosh-Hemphill Lathe, 50 H.P. motor drive. |
| TOOL | H-Style Klamp-Lok Toolholder with horizontal clamped Talide insert—Grade S-88 for roughing —Grade S-92 for finishing. |
| DEPTH OF CUT | ¼" for roughing cuts. ⅛" for finishing cuts. |
| FEED | .050 |
| S.F.M. | 125 to 210 |
| RESULTS | Talide tools held cutting edge 40% longer per grind than previous grade used — even at temperatures of 1700° F! |

### LARGE CHICAGO SHELL PLANT

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|---|---|
| PART | 105 M/M (M-1) H.E. Shell. |
| OPERATION | Rough turn shell body, 1050 Steel Forging. |
| MACHINE | 12" x 21" Fay Automatic Lathe. |
| TOOLS | TB-16 Triangular Talide Inserts with 3/32" radius vertically clamped in Klamp-Lok Toolholder Grade S-92. |
| DEPTH OF CUT | ⅜" |
| FEED | .035 |
| S.F.M. | 325 |
| RESULTS | 45 Shells per grind or 25% increase over previous average of 35 shells. |

### LARGE MID-WEST TRACTOR PLANT

| | |
|---|---|
| PART | Shaft Steering Clutch, SAE 8654-H Brinell 370. |
| OPERATION | Rough Straddle Face Flange, turn all diameters, form undercut and base. |
| MACHINE | 16 x 60 Sunstrand Automatic Lathe. |
| TOOLS | 8 Talide-tipped facing, chamfering, radius and form tools Grade S-88. 7 Klamp-Lok Toolholders with round, triangular and parallelogram Talide inserts Grade S-88. |
| DEPTH OF CUT | 9/32" to 7/16" |
| FEED | .022 |
| S.F.M. | 156 |
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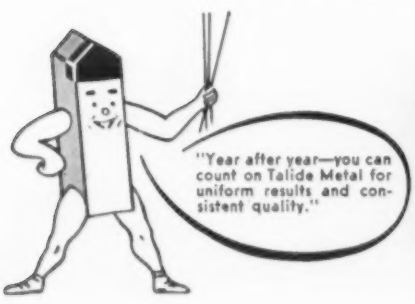
Complete stocks of standard Talide Tools and Tips are immediately available from our warehouses located in Newark, Youngstown, Detroit, Chicago and Los Angeles. Write for General Catalog No. 54-G, Metal Carbides Corporation, Youngstown 7, Ohio.

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MICROHONING = STOCK REMOVAL + GEOMETRY + SIZE CONTROL + SURFACE FINISH

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## THE AUTHORS

It is impossible here to give a complete list of all the 245 authors and editors—and the thousands of collaborators who contributed without recognition. Among them are specialists from:

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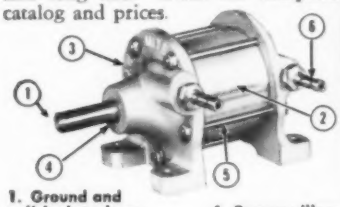


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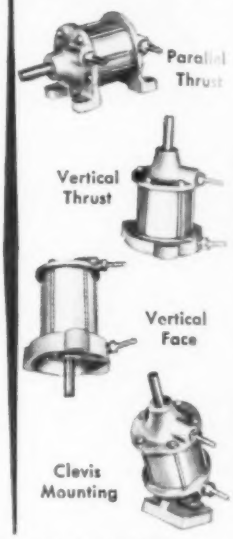

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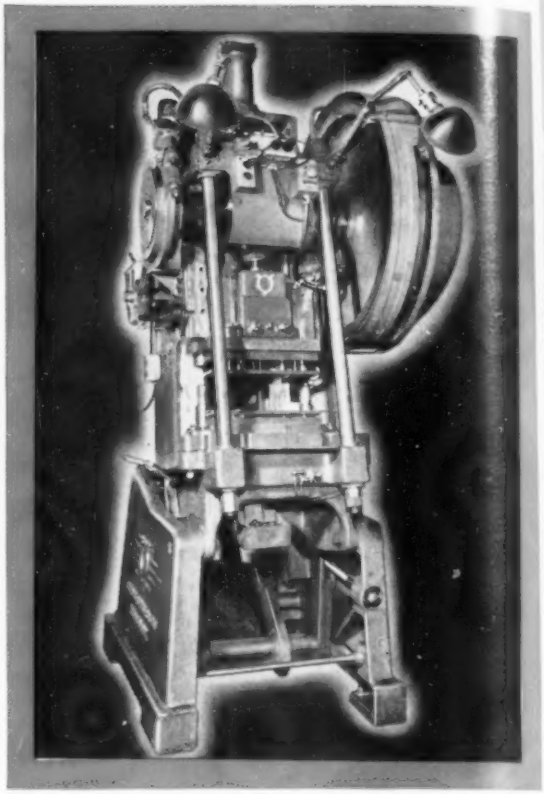

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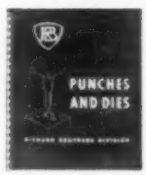


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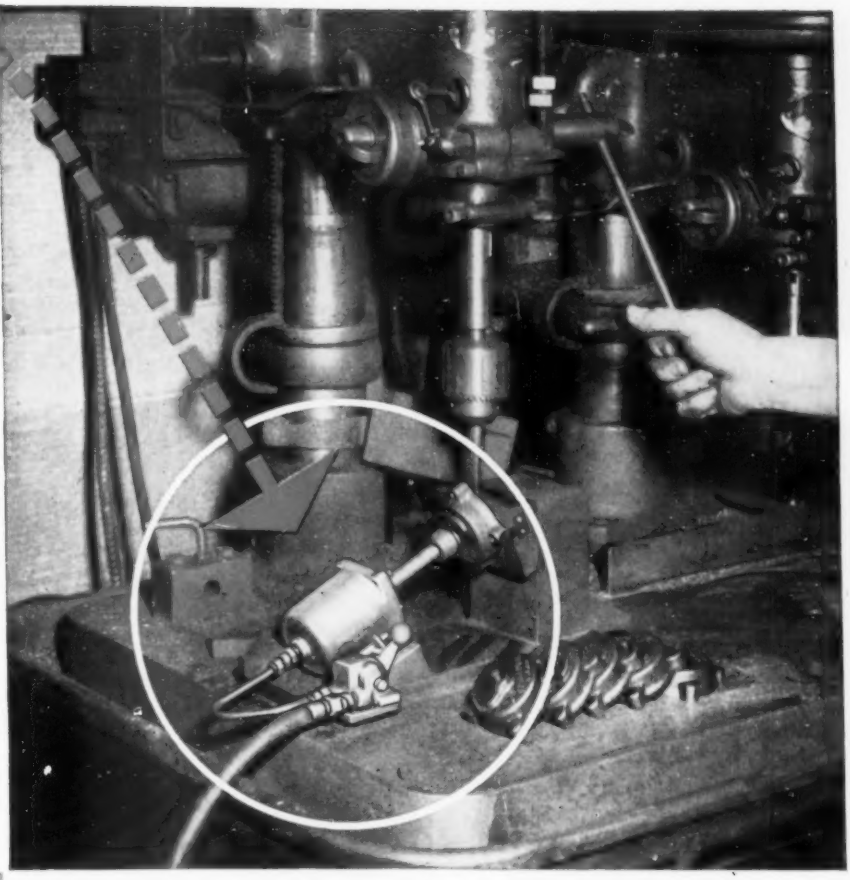
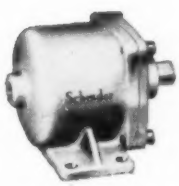


Base Mounted



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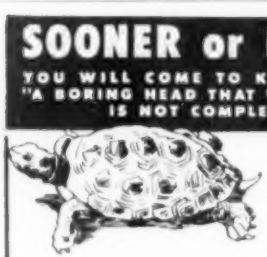

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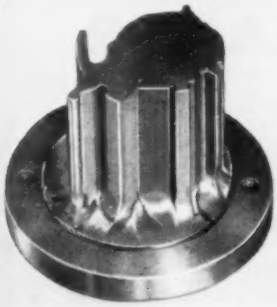
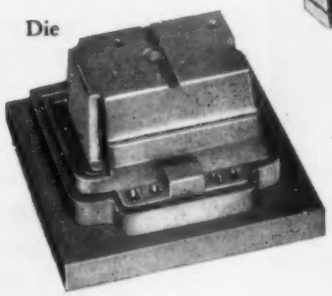
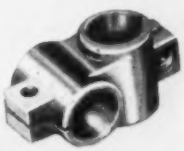


Punch



Die



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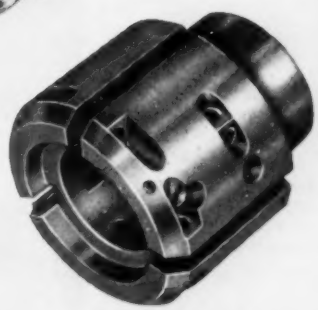

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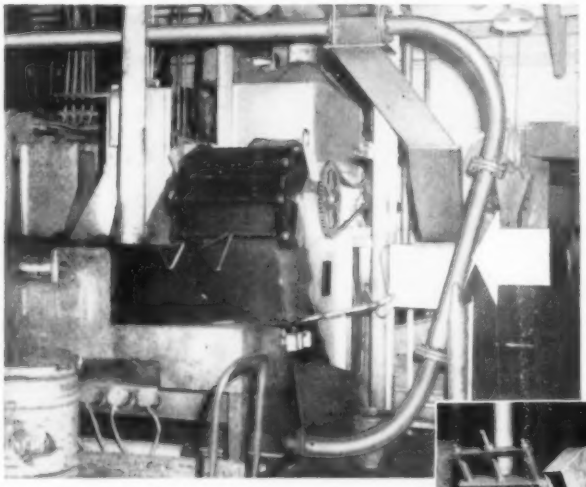

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(ANSWER NUMBER 4)

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*Write for reprint of article from Oct. 19, 1953 issue of STEEL.

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January, 1954, Issue

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## ♦USER of ASTE Data Sheets


### A

♦Acme Industrial Co. ... 252
Acme Scientific Co. ... 162
Acme Tool Co. ... 188
Adamas Carbide Corp. ... 137
Air Conversion Research Corp. ... 255
Air-Mite ... 246
Allegheny Ludlum Steel Corp. ... 231
Allied Products Corp.,
Richard Brothers Division ... 248
American Broach & Machine Co.,
Division of Sundstrand Machine Tool Co. ... 219
♦American Chain & Cable Co.,
Wilson Mechanical Instrument Division ... 240
American Roller Die Corp. ... 114
American Society of Tool Engineers ... 234, 244
American Tool Works Co., The ... 12
Ames, B. C., Co. ... 152
Ames Precision Machine Works ... 208
Ampco Twist Drill Division
Greenfield Tap and Die Corp. ... 185
Anderson, F. E., Oil Co. ... 136
Apex Tool & Cutter Co. ... 250
Armour & Co. ... 182
Armstrong-Blum Mfg. Co. ... 150
Armstrong Bros. Mfg. Co. ... 158
Atrax Co. ... 19
Automatic Methods, Inc. ... 238

### B

Baird Machine Co. ... 16
Balas Collet Mfg. Co. ... 256
Barber-Colman Co. ... 13
Barnes, W. O., Co. ... 190
Bath, John, Co., Inc. ... 172
Baumbach, E. A., Mfg. Co. ... 190
Baush Machine Tool Co. ... 181
Behr-Manning Corp. ... 174-175
Bellows Co., The ... 207
Besly-Welles Corp. ... 24
Bethlehem Steel Co. ... 195
Brown & Sharpe Mfg. Co. ... 167-168
Buck Tool Co. ... 109
Buol Machine Co. ... 252

### C

Cadillac Stamp Co. ... 212
Carlton Machine Tool Co. ... 236
Carpenter Steel Co. ... 20
Chandler Tool Co. ... 250
Cincinnati Shaper Co. ... 32-33
Coastal Abrasives Co. ... 129
Columbia Tool Steel Co. ... 146
Cone Automatic Machine Co. ... 163
Connecticut Broach & Machine Co. ... 154
Consolidated Machine Tool Corp.,
Modern Tool Works Division ... 227
Continental Tool Works,
Division of Ex-Cell-O Corp. ... Inside Back Cover
Cosa Corp. ... 251
Cro-Plate Co. ... 238
Crucible Steel Company of America,
Hollow Tool Steel Division ... 166
Tool Steel Division ... 245

### D

Danly Machine Specialties, Inc. ... 184
Darwin & Milner, Inc. ... 111
♦Davis Boring Tool Division,
Giddings & Lewis Machine Tool Co. ... 178
Denison Engineering Co. ... 246
Detroit Power Screwdriver Co. ... 22
Detroit Stamping Co. ... 146
DeVlieg Microbore Co. ... 199
Dickerman, H. E., Mfg. Co. ... 117
duMont Corp., The ... 143
♦Dumore Co., The ... 149
Dykem, Co., The ... 196

### E

Eastman Kodak Co. ... 173
♦Eclipse Counterbore Co. ... 159
Ex-Cell-O Corp.,
Continental Tool Works Division ... Inside Back Cover

### F

Farquhar, A. B., Division,
Oliver Corp. ... 153
Federal Products Corp. ... 14-15
Fellows Gear Shaper Co. ... 246
Firth-Sterling, Inc. ... 253
Foote-Burt Co. ... 180

### G

♦Gairing Tool Co. ... 142
Gammons-Hoaglund Co. ... 196
♦Gatco Rotary Bushing Co. ... 188
♦Giddings & Lewis Machine Tool Co.,
Davis Boring Tool Division ... 178
Gisholt Machine Co. ... 4, 232
Glenzer, J. C., Co. ... 170
Gorham Tool Co. ... 148
Greenfield Tap & Die Corp. ... 185, 223
Grobet File Company of America ... 202
Guthery Machine Tool Co. ... 140

### H

Hammond Machinery Builders, Inc. ... 125
Hannifin Corp. ... 192
Hansell-Elcock Co. ... 119
Hapman Conveyors, Inc. ... 252
Hardinge Brothers, Inc. ... 5
Hayes Aircraft Corp. ... 126
Heald Machine Co. ... Inside Front Cover
H. E. B. Machine Tool Co. ... 194
Heinrich Tools, Inc. ... 170
Hisey-Wolf Machine Co. ... 120
Horton Chuck ... 132
Hydraulic Press Mfg. Co., The ... 179

### I

♦Industrial Diamond Association of America ... 238
Ingersoll-Milling Machine Co. ... 183
Inspection Devices, Inc. ... 250

### J

J & S Tool Co. ... 127
Jahn, B., Mfg. Co. ... 128
♦Jones & Lamson Machine Co. ... 189

### K

Kearney & Trecker Corp. ... 191
Keller Tool Co. ... 110
Kennametal, Inc. ... 113
Kling Bros. Engineering Works ... 34

### L

Landis Machine Co. ... 8-9
Lapointe Machine Tool Co., The ... 21
Latrobe Steel Co. ... 36
Lavallee & Ide, Inc. ... 135
Lee, K. O., Co. ... 162
Lincoln Park Industries, Inc. ... 155
Lindberg Engineering Co. ... 216
Lodding, Inc. ... 235

### M

Manhattan Rubber Division,
Raybestos-Manhattan, Inc. ... 201
Maxwell Co., The ... 250
M. B. I. Export and Import, Ltd. ... 23
Mercury Engineering Co. ... 210
Metal Carbides Corp. ... 242
Meyers, W. F., Co. ... 170
Micromatic Hone Corp. ... 243
Miller Motor Co. ... 171
Modern Tool Works Division,
Consolidated Machine Tool Corp. ... 227
Morey Machinery Co., Inc. ... 188
Morse Twist Drill & Machine Co. ... 26-27
Morton Machine Works ... 208
Motch & Merryweather Machinery Co., The ... 247

### N

National Broach & Machine Co. ... 222
National Tool Co. ... 230
♦National Twist Drill & Tool Co. ... 6-7
Nelco Tool Co. ... 138
New Britain Machine Co., The ... 200
Nilsson Gage Co. ... 126
Norton Co.,
Machine Division ... 177
Abrasive Grinding Wheels Division ... 226
Nu Tangs, Inc. ... 196

### O

Oakite Products, Inc. ... 157
Ohio Crankshaft Co. ... 213
Ohio Knife Co. ... 197
Oliver Corp.,
A. B. Farquhar Division ... 153
Optical Gaging Co. ... 164
Ortman-Miller Machine Co. ... 225
Ottemiller, Wm. H., Co. ... 255

### P

Parker-Majestic, Inc. ... 220
Parkwood Laminates, Inc. ... 196
Pioneer Tool & Engineering Co. ... 145
Pope Machinery Co. ... 11
Porter Precision Products ... 162
Potter & Johnston Co.,
Pratt & Whitney Division,
Niles-Bement-Pond Company ... 161

R

L Tools, Inc. ..... 187
estos-Manhattan, Inc.,
nhattan Rubber Division ..... 201
ards, J. A. Co. ..... 208
Punch & Die Co. ..... 190
tt Lathe & Grinder Co. ..... 239
hard Brothers Punch Division.
lled Products Corp. ..... 248
ers Machine Works ..... 176
ald Press Co. ..... 124
Tool Co. ..... 151
ell, Holbrook & Henderson, Inc. ..... 211
hman Machinery Co. ..... 240

S

dvick Steel Corp.,
Coromant Division ..... 237
Scherr, George, Co., Inc. ..... 202
Schmidt, George T., Co. ..... 130
Schrader's, A. & Son
Division of Scoville Mfg. Co., Inc. ..... 249
Service Machine Co. ..... 240
Severance Tool Industries, Inc. ..... 255
Sheldon Machine Co. ..... 144
Sidney Machine Tool Co. ..... 198
Simonds Saw & Steel Co. ..... 221
Simplex Machine Tool Corp. ..... 228
Skinner Chuck Co. ..... 139
Smit, Anton, & Son ..... 203-206
Snow Mfg. Co. ..... 156
Snyder Tool Co. ..... 25
Sorenson Center-Mike Corp. ..... 143
South Bend Lathe Works ..... 119
S-P Mfg. Corp. ..... 145
Standard Gage Co. ..... 30-31
Standard Machine & Tool Co., Ltd. ..... 190
Standard Parts Co. ..... 123
Standard Pressed Steel Co. ..... 218
Standard Tool Co. ..... 29
Starrett, L. S., Co., The ..... 28
Steel City Testing Machines ..... 131
Sturetevant, P. A., Co. ..... 202
Sun Oil Co. ..... 2
Sundstrand Machine Tool Co. ..... 214-215
Sundstrand Machine Tool Co.,
American Broach & Machine Co., Division ..... 219
Super Tool Co. ..... 241
Swartz Tool Co. ..... 193
Syntron Co. ..... 116

T

Taft-Peirce Mfg. Co. ..... 160
Taylor Dynamometer Co. ..... 124
Threadwell Tap & Die Co. ..... 122

U

U. S. Drill Head Co., The ..... 115
Universal Engineering Co. ..... 169

V

Vanadium-Alloy Steel Corp. ..... 165
Verson Allsteel Press Co. ..... Back Cover
Vlier Mfg. Co. ..... 217
Vulcan Tool Co. ..... 246

W

Waldes Kohinoor, Inc. ..... 209
Wales-Strippit Corp. ..... 17
Walker, O. S., Co., Inc. ..... 118
Warner & Swasey Co., Inc. ..... 18
Waukesha Tool Co. ..... 229
Wesson Co. ..... 10
Western Tool & Mfg. Co. ..... 202
Wilson Mechanical Instrument Division.
American Chain & Cable Co. ..... 240
Winter Brothers,
Division of National Twist Drill & Tool Co. ..... 6-7

Z

Zager Tool Co. ..... 233
Ziegler, W. M., Tool Co. ..... 240


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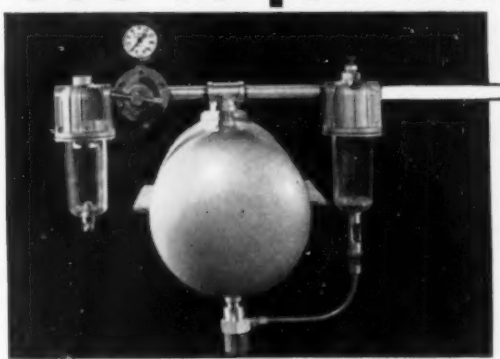

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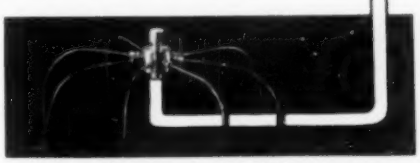

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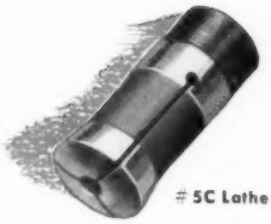

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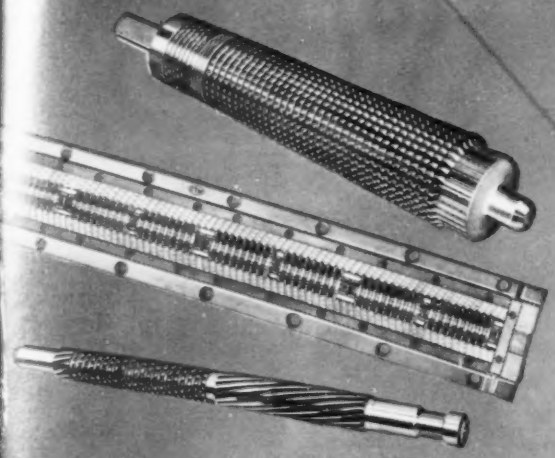

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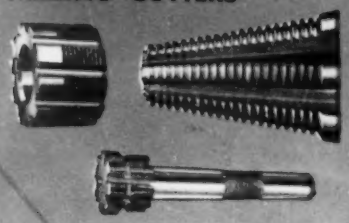
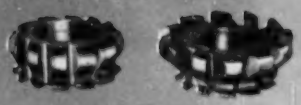
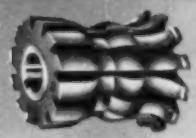




FORM-RELIEVED MILLING CUTTERS





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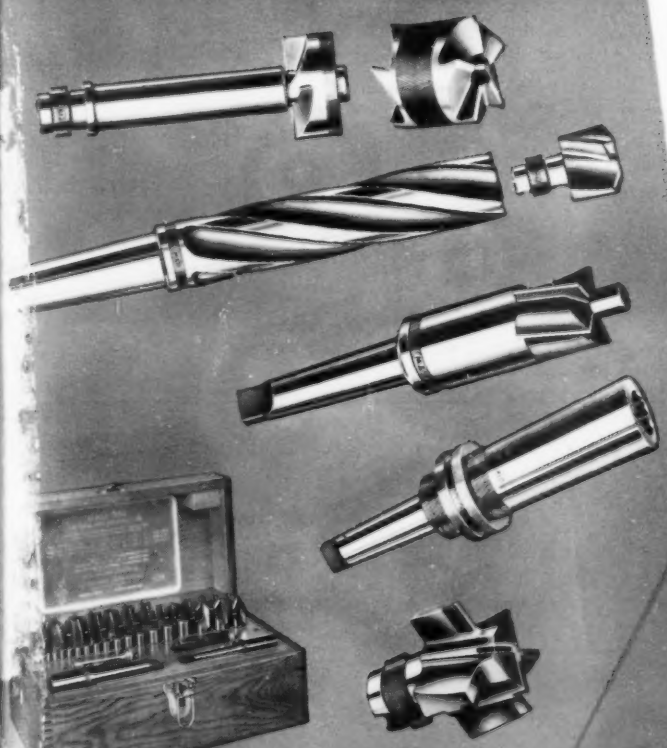

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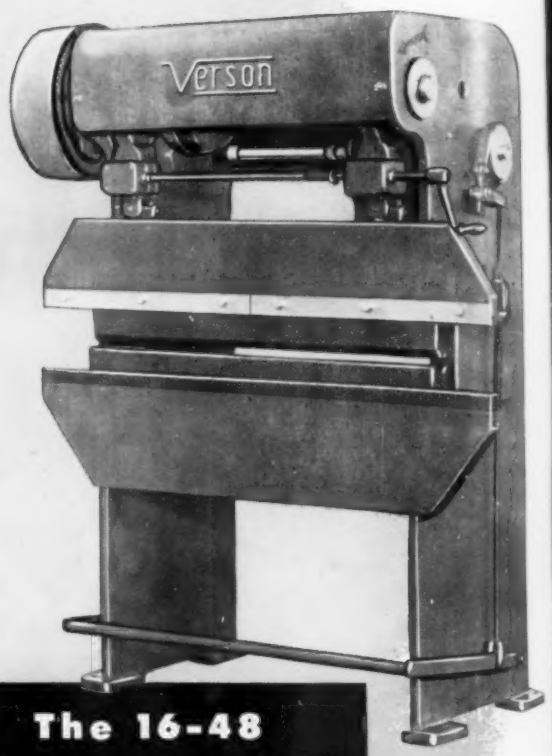


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